GEOTECHNICAL EVALUATION
USDA, FOREST SERVICE
LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

PREPARED FOR:
United States Department of Agriculture, Forest Service
333 Broadway, SE
Albuquerque, New Mexico 87102

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
3001 South 35th Street, Suite 6
Phoenix, Arizona 85034

December 31, 2004
Project No. 600587004

December 31, 2004
Project No. 600587004

Mr. Richard Miller, P.E.
United States Department of Agriculture, Forest Service
333 Broadway, SE
Albuquerque, New Mexico 87102

Subject: Geotechnical Evaluation
United States Department of Agriculture, Forest Service
Lost Lodge Administration Site
Cloudcroft, New Mexico
Contract No. 53-8371-4-0099
Task Order No. 4

Dear Mr. Miller:

In accordance with our revised proposal dated September 17, 2004, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project. If you have any questions or comments regarding this report, please call at your convenience.

Sincerely,
NINYO & MOORE

Steven D. Nowaczyk, P.E.
Senior Project Engineer

ROBERT W. MCMICHAEL
NEW MEXICO
16582
LICENSED PROFESSIONAL ENGINEER

Robert W. McMichael, P.E.
Manager/Chief Engineer

JSR/SDN/JCN/RM/avv

Distribution: (1) Addressee
(1) Mr. Bill Kelley – USDA, Forest Service

TABLE OF CONTENTS

Tables

Illustration

Appendices

1. INTRODUCTION

In accordance with your authorization and our revised proposal dated September 17, 2004, Ninyo & Moore has performed a geotechnical evaluation for the proposed Lost Lodge Administration site to be located near Cloudcroft, New Mexico. The purpose of our evaluation was to assess the subsurface conditions at the project site in order to formulate geotechnical recommendations for design and construction. This report presents the results of our evaluation and our geotechnical conclusions and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

The scope of our services for the project generally included:

- Reviewing readily available aerial photographs and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Marking out test pit locations based on the drawings provided by the United States Department of Agriculture, Forest Service (USDA-FS) and notifying New Mexico One Call prior to the field work.
- Excavating, logging, and sampling 10 exploratory test pits to depths of about 1 to 2.5 feet below ground surface (bgs). The test pit logs are presented in Appendix A.
- Performing one field infiltration test (percolation test) at the site, with the results reported in cubic feet per hour per square foot of percolation area.
- Performing laboratory tests of selected samples obtained from the excavations to evaluate in-situ moisture content and organic matter percentage. The results of the laboratory testing are presented on the test pit logs and/or Appendix B.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the project.

3. SITE DESCRIPTION

The 28.5-acre project site is located in the eastern quarter of Section 6, Township 16 South, Range 12 East. The site is situated approximately 1.5 miles south of United States Route 82, at the southwest corner of the intersection of State Route 130 and Lost Lodge Road. The approximate location of the site is depicted on the Site Location Map (Figure 1). At the time of our

evaluation, the project site was undeveloped and covered with scattered forest vegetation. Unpaved roads and footpaths crossed the site at several locations.

According to the topographic information provided by the USDA-FS, the site elevations within the anticipated development areas range between roughly 8,703 and 8,717 feet relative to mean sea level (MSL). Based on this topographic information, the ground surface at the proposed building and pavement areas generally slopes from the north to the south.

One aerial photograph was reviewed for this project; a 1996 United States Geological Survey (USGS) aerial photograph depicted the site as being very similar to its current condition. Our limited evaluation of the aerial photograph and visual reconnaissance did not indicate any large disturbed areas that might be indicative of past development or filling.

4. PROPOSED CONSTRUCTION

The project will generally consist of the design and construction of an administration facility for the USDA-FS. The new construction will consist of a single-story office building, visitor contact station, access roads, several parking areas, a warehouse and a garage for fire engines. A septic field is also proposed to support the facilities. In general, the office building and visitor contact station will be located on the eastern half of the project site, while the warehouse and garage will be located on the western half of the site. For the purposes of our study, we have assumed the structural loads associated with these buildings will not exceed about 3.5 kips per linear foot for walls, 100 kips for columns, and 150 pounds per square foot (psf) for slabs-on-grades. For the paved areas, we assume that both asphaltic concrete and Portland cement concrete sections will be considered.

The grading plans were not available during the writing of this report. However, we assume that the finish floor elevation of the new building and pavement areas will roughly match the existing ground contours and grading will be kept at a minimum. For the purpose of this report, we assume that the cuts and fills needed to establish the final grades will be less than about 3 to 5 feet.

5. FIELD EXPLORATION AND LABORATORY TESTING

On October 7, 2004, Ninyo & Moore conducted a subsurface evaluation at the site in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Our evaluation consisted of the excavation, logging, and sampling of 10 test pits, designated as TP-1 through TP-10. The test pits were excavated using a backhoe at locations that approximate the general development areas associated with this project. The test pits were originally scheduled to extend 10 feet deep; however, refusal on limestone precluded our excavations from reaching the target depths. Consequently, the test pits were excavated to depths of about 1 to 2.5 feet bgs. Bulk samples were collected at each test pit and returned to our laboratory for further evaluation. Detailed descriptions of the materials encountered in the excavations are presented in the test pit logs in Appendix A.

The ground surface elevation at each test pit location was estimated from the topographic information we received from the USDA-FS and is depicted on the logs. The general locations of the test pits are denoted on the Test Pit Location Map (Figure 2).

The soil samples collected from our excavation activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analysis. The analysis included in-situ moisture content and organic matter testing. The results of the in-situ moisture content testing are presented on the test pit logs in Appendix A. A description of each laboratory test method and the remainder of the test results are presented in Appendix B.

In order to assist in evaluating the infiltration rate at a specific location, Ninyo & Moore conducted one shallow infiltration test. The test was performed approximately 10 feet southwest of test pit TP-6. The infiltration test procedure included the excavating of a small hole to a depth of about 22 inches. The hole was cleaned of loose soil and a 10-inch inside diameter (10.5-inch outside diameter) solid Poly Vinyl Chloride (PVC) casing was inserted to the bottom of the hole. The PVC casing was filled with water in order to pre-wet the soil. The test continued after the prewetting period by refilling the casing and monitoring the drop in water level as a function of time until steady-state conditions were achieved. The results of this test are provided in Appendix C.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

6.1. Geologic Setting

The project area is located in the Sacramento Mountains, in what is known as the eastern boundary of the Basin and Range province. The Sacramento Mountains are typified by their abrupt increase in elevation greater than a mile above the Tularosa Valley. The mountains are composed mostly of Paleozoic sedimentary rock units, typically limestone, dolomite, siltstone, and a few windows of black shale. The area of the site, which is located on the south side of Lost Lodge Road, was mapped as Permian age San Andres formation limestone rocks (New Mexico Bureau of Geology and Mineral Recourses, 2003).

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field exploration and laboratory testing, and our understanding of the general geology of the area. The following sections provide a generalized description of the materials encountered. More detailed descriptions are presented on the test pit logs in Appendix A.

6.2.1. Residuum

Residuum material generally consisting of sandy clay and silty sand was encountered at the surface of each of the test pit excavations. This residuum material extended about 6 inches to 2 feet bgs in our explorations. Laboratory testing conducted on select samples indicated that these residuum soils have in-place organic contents ranging from approximately 16 to 17 percent.

6.2.2. San Andres Formation

San Andres formation limestone was observed below the residuum materials at the test pit locations and extended to the total depths explored. Backhoe refusal occurred in this limestone formation within our test pit excavations.

6.3. Groundwater

Groundwater was not encountered in our test pit excavations. Based on well data from the New Mexico Office of the State Engineer, the approximate depth to groundwater near the project area typically ranges from approximately 227 to 340 feet bgs. However, groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors.

7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, faulting and seismicity, surface rupture, and liquefaction.

7.1. Faulting and Seismicity

The site lies within the Sacramento Mountain zone that generally has low rates of seismotectonic activity. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest faults to the site are the Alamogordo fault, Sacramento Mountains Section, and the Guadalupe Fault. The Alamogordo Fault is located approximately 30 miles to the west of the site. The Guadalupe Fault is located approximately 30 miles to the southeast of the site. Approximately 10 meters of displacement has occurred along the Alamogordo Fault within late Pleistocene deposits (<750,000 years) and early Holocene deposits. The recent deformation along the fault has been in the Late Quaternary (<15,000 years). An average slip rate along the fault is classified as less than 0.2 millimeters per year. Approximately 12 meters of displacement have occurred along the Guadalupe Fault within late Quaternary deposits. An average slip rate along the fault is classified as less than 0.2 millimeters per year (New Mexico Bureau of Mines and Minerals, 1996).

Based on a Probabilistic Seismic Hazard Assessment for the Western United States, issued by the USGS (1999), the site is located in a zone where the peak ground accelerations that have a 10 percent, 5 percent, and 2 percent probability of being exceeded in 50 years are 0.05g, 0.08g and 0.14g, respectively. These ground motion values are calculated for "firm

rock" sites, which correspond to a shear-wave velocity of approximately 2,500 feet per second in approximately the top 100 feet bgs. Different soil sites may amplify or de-amplify these values. Seismic design parameters according to the 2003 International Building Code (IBC) are presented in Table 1.

Table 1 – Seismic Design Parameters

Parameter	Value	2003 IBC Reference
Site Class Definition	B	Table 1615.1.1
Site Coefficient F_a	1.0	Table 1615.1.2(1)
Site Coefficient F_v	1.0	Table 1615.1.(2)

7.2. Liquefaction Potential

Based on the lack of near surface water, and the low ground motion hazard (relatively low ground accelerations), the likelihood or potential for liquefaction at the project site is not a design consideration.

8. CONCLUSIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- The results of our field exploration program indicate that the project site, as presently proposed, is underlain by sandy clay and silty sand residuum material over San Andres formation limestone. The residuum soils should generally be excavatable by standard- to heavy-duty equipment; however, the limestone will need more aggressive excavation techniques.

- Because of the high organic matter content observed from our laboratory testing (16 to 17 percent), we recommend that the residuum soils be removed below at-grade structures, (e.g., grade slabs, pavements, flatwork, etc,) and be replaced with non frost-susceptible engineered fill.

- Based on a preliminary evaluation of slope stability, cut or fill slopes up to 10 feet high should be no steeper than 2 horizontal to 1 vertical. If a steeper or higher slope is needed, Ninyo & Moore should be consulted and/or a retaining structure may be considered.

- Shallow spread footings should be used to support the new structures. The spread footings for each individual structure should bear either on the underlying limestone layer or on a mat of 2 or more feet of newly placed engineered fill that extends to the limestone. Structures should not be supported over a transition from limestone to fill soils. Footings bearing on limestone should be embedded 6 or more inches into this layer.

- Floor slabs, pavements, and exterior concrete flatwork areas should be reinforced per the recommendations of the structural engineer and supported on engineered fill.

- A shallow groundwater table is not anticipated within the project site during construction. Surface run-off could, however, be anticipated in existing drainages. In addition, seasonal perching above the underlying limestone may be encountered.

- The Alamogordo Fault is located approximately 30 miles to the west of the site. The Guadalupe Fault is located approximately 30 miles to the southeast.

9. RECOMMENDATIONS

The following sections present our geotechnical recommendations for the proposed construction. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

9.1. Earthwork

The following sections provide our earthwork recommendations for this project. Other recommendations for grading and earthwork are included in our Earthwork Specifications Recommendations, Appendix D. If there are conflicting recommendations, those provided in this report supersede those in Appendix D.

9.1.1. Excavation Characteristics

The results of our field exploration program indicate that the project site, as presently proposed, is underlain by sandy clay and silty sand residuum material over San Andres formation limestone. The residuum soils should generally be excavatable by standard- to heavy-duty equipment; however, the limestone will likely call for more aggressive excavation techniques. Table 2 summarizes the depths to the surface of the limestone and the depths to backhoe refusal for each test pit we excavated.

Table 2 – Summary of Depths to Limestone Surface

Test Pit No.	Approximate Depth to Surface of Limestone (feet bgs)	Depth to Backhoe Refusal (feet bgs)
TP-1	2.0	2.2
TP-2	2.2	2.5
TP-3	0.5	0.9
TP-4	1.2	1.5
TP-5	1.5	1.9
TP-6	2.2	2.4
TP-7	1.5	1.9
TP-8	1.9	2.9
TP-9	0.9	2.5
TP-10	1.8	1.9

Although we were unable to evaluate rippability with the backhoe equipment we had on site, we anticipate that a hoe-ram, ripper, special excavation equipment, and/or blasting may be needed to facilitate excavations and/or trenching within this limestone layer. We suggest that a contractor with experience in difficult excavation conditions be consulted for excavation alternatives and be consulted for expert advice on excavation methodology. The depths of refusal indicated in Table 2 do not represent excavation conditions to be encountered during construction, as different equipment will likely be used.

The contractor should provide safely sloped excavations or an adequately constructed and braced shoring system, in compliance with Occupational Safety and Health Administration regulations, for employees working in an excavation that may expose employees to the danger of moving ground. If material is stored or equipment is operated near an excavation, stronger shoring should be used to resist the extra pressure due to superimposed loads.

9.1.2. Grading, Fill Placement, and Compaction

Vegetation and debris from the clearing operation should be removed from the site and disposed of at a legal dumpsite. Demolition debris should be removed from the site and

disposed of at a legal dumpsite. Obstructions that extend below finish grade, if present, should be removed and the resulting holes filled with compacted soil.

Because of the high organic matter observed from our laboratory testing (16 to 17 percent), we recommend that the residuum soils be removed below at-grade structures, (e.g., grade slabs, pavements, flatwork, etc,) and be replaced with non frost-susceptible engineered fill. The removal depth of these residuum soils below structural areas should extend to the surface of the underlying limestone layer. The removed residuum soils should either be removed from the site or placed in non-structural areas within the project site.

Depending on the excavation method, the proposed excavations could generate oversize material (particles larger than 6 inches) that will not be suitable for reuse as engineered fill. This material should be disposed of off site or in non-structural areas. Further details are provided in Appendix D.

New fill should be placed in horizontal lifts approximately 9 inches in loose thickness and compacted by appropriate mechanical methods, to 95 percent or more relative compaction, in accordance with ASTM D 698-00 at a moisture content within two percent of its optimum moisture.

Fill material used in trench excavations should be moisture conditioned to a moisture content within 2 percent of its optimum. Placed backfill should be mechanically compacted to a relative compaction of 95 or more percent of the maximum dry density as evaluated by ASTM D 698-00. Lift thickness for backfill will be dependent upon the type of compaction equipment utilized, but should generally be placed in uniform lifts not exceeding 9 inches in loose thickness. Special care should be exercised to avoid damaging the pipe or other structures during the compaction of the backfill. In addition, the underside (or haunches) of the buried pipe should be supported on bedding material that is compacted as described above. This may require placement by hand or small-scale compaction equipment.

9.1.3. Imported Fill Material

Imported fill should consist of clean, granular material with a very low or low expansion potential. Very low to low expansive potential soils are defined as having an Expansion Index (by ASTM 4829-95) of 50 or less. Furthermore, suitable import fill should be non frost-susceptible and should not include organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 6 inches in dimension.

Import material in contact with ferrous metals or concrete should preferably have low corrosion potential (minimum resistivity greater than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm], and soluble sulfate content of less than 0.1 percent). The geotechnical consultant should evaluate such materials and details of their placement prior to importation.

9.2. Foundations

Shallow spread footings should be used to support the new structures. Due to the presence of organic surface residuum soils and shallow limestone, differential foundation bearing and soil subgrade conditions should be anticipated. The site preparation should reflect our recommendation that structural foundations be either completely supported on limestone, judged to be competent by an engineering geologist or geotechnical engineer, or on moisture-conditioned and compacted engineered fill material that extends 2 or more feet below the bottom of the footing. The engineered fill should extend to competent limestone material. The overexcavation zone, if needed, should extend laterally 2 feet or more horizontally beyond the foundation footprint. Moreover, the design should avoid supporting any single structure over a horizontal cut/fill transition between engineered fill material and any underlying near surface limestone. This may result in needing to overexcavate the limestone in some areas where footings will be placed over a cut/fill transition. This overexcavation of the limestone (where needed) should extend to a depth of 2 or more feet below the bottom of the footing. In other words, we recommend that there be 2 or more feet of engineered fill be-

tween the foundation and the limestone, for structures within fill areas of the site. Footings bearing on limestone should be embedded 6 or more inches into the limestone.

Following the earthwork improvements as described above, and prior to the placement of new fill, the resulting exposed surface should be carefully evaluated by the geotechnical consultant. Based on this evaluation, additional remediation may be needed. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations.

We recommend utilizing spread or continuous footings for this project. Spread or continuous footings should be supported at a depth of 36 or more inches below the lowest adjacent grade on either limestone or on moisture-conditioned and compacted engineered fill material as described above. Continuous footings should have a width of 12 or more inches, and isolated spread footings should have a width of 24 or more inches. Spread or continuous footings should be reinforced in accordance with the recommendations of the structural engineer. Footings may be designed using an allowable bearing capacity of up to 3,000 psf for static conditions. Higher bearing pressures are feasible if the foundations bear exclusively on the limestone; however, our office should be consulted if this alternative is employed. Total and differential settlement of about 1/2 inch or less, and 1/4 inch, respectively, may occur.

Foundations bearing on either limestone or on moisture-conditioned and compacted engineered fill material and subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.40 (total frictional resistance equals the coefficient of friction multiplied by the dead load). A passive resistance value of 250 psf per foot of depth can be used. The ultimate lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces. The foundations should preferably be proportioned such that the resultant force from lateral loadings falls within the kern (i.e., middle one-third).

9.3. Floor Slabs

The design of the floor slabs is the responsibility of the structural engineer. However, from a geotechnical standpoint, we recommend that the floor slab have a thickness of 4 or more inches and be reinforced with steel as designed by a structural engineer. Placement of the reinforcement in the slab is vital for satisfactory performance. The need for a moisture-retarding system and/or vapor barrier should be considered by the structural engineer or architect based on the moisture sensitivity of the anticipated flooring.

We recommend that a 4 or more inch thick base course or leveling pad be placed below the floor slabs. We recommend that this material conform to the following gradation specification: 100 percent of the material passing the 1.5 inch sieve, 90 to 100 percent of the material passing the 1 inch sieve, 35 to 55 percent of the material passing the No. 8 sieve, and no more than 8 percent passing the No. 200 sieve.

The floor slab should either be constructed so that it "floats" independent of the foundations or be designed to be structurally connected to the foundations. Soils underlying the slabs should be removed and replaced with engineered fill (per the recommendations in Section 9.1.2). The improved zone below the grade slabs should extend laterally 12 or more inches horizontally beyond the slab footprint. Slabs should not be constructed on limestone. We recommend a 6 inch thick cushion of engineered fill be placed between the limestone surface and the bottom of the slab's base course or leveling pad. Joints should be constructed at intervals designed by the structural engineer to help reduce random cracking of the slab.

9.4. Retaining Walls

Retaining wall foundations, if any, should be founded in the manner described in Section 9.2. Retaining walls that are not restrained from movement at the top and have a level backfill behind the wall may be designed using an "active" equivalent fluid unit weight of 35 pounds per cubic foot (pcf). This value assumes compaction within about 5 feet of the wall will be accomplished with relatively light compaction equipment, and that very low to low expansive backfill will be placed behind the wall. This value also assumes that the retaining walls will have a height less than 12 feet. Retaining walls should also be designed

to resist a surcharge pressure of 0.35q. The value for "q" represents the pressure induced by adjacent light loads, uniform slab, or traffic loads plus any adjacent footing loads.

Measures should be taken so that moisture does not build up behind retaining walls. Retaining walls should be provided with a drain, as shown on Figure 4. Back drainage measures should include free-draining backfill material and perforated drainpipes or weepholes. Drainpipes should outlet away from structures, and retaining walls should be waterproofed in accordance with the recommendations of the project civil engineer or architect. To reduce the potential for water- and sulfate/salt-related damage to the retaining walls, particular care should be taken in the selection of the appropriate type of waterproofing material to be utilized and in the application of this material.

For passive resistance to lateral loads, we recommend that an equivalent fluid weight of 250 pcf be used up to a value of 3,000 psf. This value assumes that the ground is horizontal for a distance of 10 feet or more behind the wall or three times the height generating the passive pressure, whichever is greater. We recommend that the upper 12 inches of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance. For frictional resistance to lateral loads, we recommend that a coefficient of friction of 0.35 be used between soil and concrete. If passive and frictional resistances are to be used in combination, we recommend that the friction coefficient be reduced by two-thirds. The passive resistance values may be increased by one-third when considering loads of short duration, such as wind or seismic forces.

9.5. Slopes

In general, cut slopes and excavations within the surface residuum soils should be inclined no steeper than 2:1 (horizontal: vertical). Cut slopes and excavation within the underlying limestone should be inclined no steeper than 0.5:1 (horizontal: vertical). We recommend that new fill slopes associated with this project be inclined no steeper than 2:1 (horizontal: vertical). These guidelines pertain to slope heights of 10 feet or less.

9.6. Pavements

For the paved areas, we understand that both asphaltic concrete and Portland cement concrete sections may be considered. The pavement sections given below are assumed to bear on imported soils with an average soil R-value of 20 or more.

Portland cement concrete pavements are recommended for areas that will experience regular truck traffic, loading dock areas, main ingress and egress areas, and in areas where vehicles will be turning or loading (e.g., adjacent to trash dumpsters). Portland cement concrete in heavy traffic areas should have a thickness of 8 inches or more, with edges thickened to 10 inches. In parking areas not subject to truck traffic, the concrete pavement thickness can be reduced to 6 inches, with edges thickened to 8 inches.

Concrete pavements should have longitudinal and transverse joints that meet the applicable requirements of the local governmental agency. Concrete pavements should be underlain by 4 inches or more of aggregate base. The aggregate base should conform to the requirements for a "D Base" from Section 700 of the FHWA FP-03 specification and/or any Otero County requirements; the recommended gradation according to Section 700 is shown in Table 4.

Table 3 – Recommended Aggregate Base Gradation

Sieve Size (per ASTM D422-63)	Percent Passing by Weight
1 Inch	100
3/4 Inch	86-100
3/8 Inch	51-82
No. 4	36-64
No. 40	12-26
No. 200	4-7
P.I. Max.	5

An asphalt pavement section consisting of 3 or more inches of plant-mix asphalt over 6 or more inches of graded aggregate base can be considered in the lighter loaded parking areas. For heavier-traveled areas of the parking lot, an asphalt pavement section consisting of 4 or

more inches of plant-mix asphalt over 9 or more inches of graded aggregate base can be utilized.

For both the Portland cement concrete and asphalt pavements given above, we recommend the underlying subgrade soils be removed and replaced with engineered fill (per the recommendations in Section 9.1.2). The improved zone below the pavements should extend laterally 12 or more inches horizontally beyond the pavement footprint. In addition, pavements should not be constructed on limestone. We recommend a 6 inch thick cushion of engineered fill be placed between the bottom of the aggregate base and the limestone surface. Aggregate base material should be compacted to a relative compaction of 95 percent or more of the maximum dry density, as evaluated by ASTM D 698-00, at a moisture content within approximately 2 percent of optimum.

9.7. Concrete Flatwork

To reduce the potential manifestation of distress to exterior concrete flatwork due to movement of the underlying soil, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as designed by the structural engineer. Soils underlying the concrete flatwork should be removed and replaced with engineered fill (per the recommendations in Section 9.1.2). The improved zone below the flatwork should extend laterally 12 or more inches horizontally beyond the flatwork footprint. Positive drainage should be established and maintained adjacent to flatwork.

9.8. Concrete

We recommend the use of Type II cement for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, pozzalon or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio no greater than 0.45 by weight for normal weight aggregate concrete. The structural engineer should ultimately se-

lect the concrete design strength based on the project specific loading conditions. However, higher strength concrete may be selected for increased durability, resistance to slab curling and shrinkage cracking. Concrete that is exposed to the environment should be air-entrained. The amount of entrained air should vary between 5 and 8 percent.

In order to reduce the potential for shrinkage cracks in the concrete during curing, we recommend that for slabs-on-grade, the concrete be placed with a slump in accordance with Table 5.2.1 of Section 302.1R of "Guidelines for Floor and Slab Construction," or Table 2.2 of Section 332R in "Guidelines for Residential Cast-in-Place Concrete Construction." If a higher slump is needed for screeding and leveling, a super plasticizer is recommended to achieve the higher slump without changing the recommended water to cement ratio. The slump should be checked periodically at the site prior to concrete placement. We also recommend that crack control joints be provided in slabs in accordance with the recommendations of the structural engineer to reduce the potential for distress due to minor soil movement and concrete shrinkage. We further recommend that concrete cover over reinforcing steel for slabs on grade and foundations be in accordance with Universal Building Code (UBC) 1907.7.1. The structural engineer should be consulted for additional concrete specifications.

9.9. Percolation

As mentioned earlier in this report, in order to assist in evaluating the infiltration or percolation rate on the on-site soils at a specific location, Ninyo & Moore conducted one shallow field infiltration test for this project. The test results indicated that the infiltration rate of the soil at the location and depth tested was on the order of 2.5 feet per hour or 2.0 minutes per inch. Based on commonly used criterion used for designing septic fields, the estimated Soil Absorption Rate for shallow disposal field systems at the test location could be on the order of 1.2 gallons per day per cubic foot. Please note that the above estimated Soil Absorption Rate is for soil materials. Differing Sol Absorption Rates should be expected within limestone materials. Moreover, a perched condition may be encountered on shallow limestone materials.

9.10. Site Drainage

Positive surface drainage should be provided to divert water away from structures and off flatwork slabs and pavement surfaces. Surface water should not be permitted to drain toward the structures or to pond adjacent to footings or on grade slabs and pavement areas. Due to the steeply sloping ground surface at and surrounding the site, consideration should also be given to diverting sources of run-on water from areas adjacent to the site.

Positive drainage is defined as a slope of 2 or more percent for a distance of 5 feet or more away from the structures. Roof gutters should be installed on structures. Downspouts should discharge to drainage systems away from structures, pavements, and flatwork. The landscape design should consider the moisture sensitive nature of the native residuum. Constructed slopes associated with this project should be protected from erosion per the recommendations of the civil engineer. Further details are provided in Appendix D.

9.11. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

9.12. Construction Observation and Testing

Due to the limited extent of our test pit excavations (caused by backhoe refusal on limestone) and the conceptual nature of the layout of the site feature, we highly recommend that during construction operations, a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, including the extent and depth of overexcavation, to evaluate the suitability of proposed borrow materials for use as fill and to observe placement and test compaction of fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recom-

mendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed improvements.

10. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encoun-

tered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

11. SELECTED REFERENCES

American Concrete Institute, 1991a, Guidelines for Concrete Floor and Slab Construction (ACI 302.1R).

American Concrete Institute, 1991b, Guidelines for Residential Cast-in-Place Concrete Construction (ACI 332R).

American Society for Testing and Materials (ASTM), 1997 Annual Book of ASTM Standards.

International Conference of Building Officials, 1997, Uniform Building Code: Whittier California.

New Mexico Bureau of Geology and Mineral Recourses, Geologic Map of New Mexico, 2003

New Mexico Bureau of Mines and Mineral Resources, 1996, Partial Report for Alamogordo Fault, Sacramento Mountains section, No. 2054b.

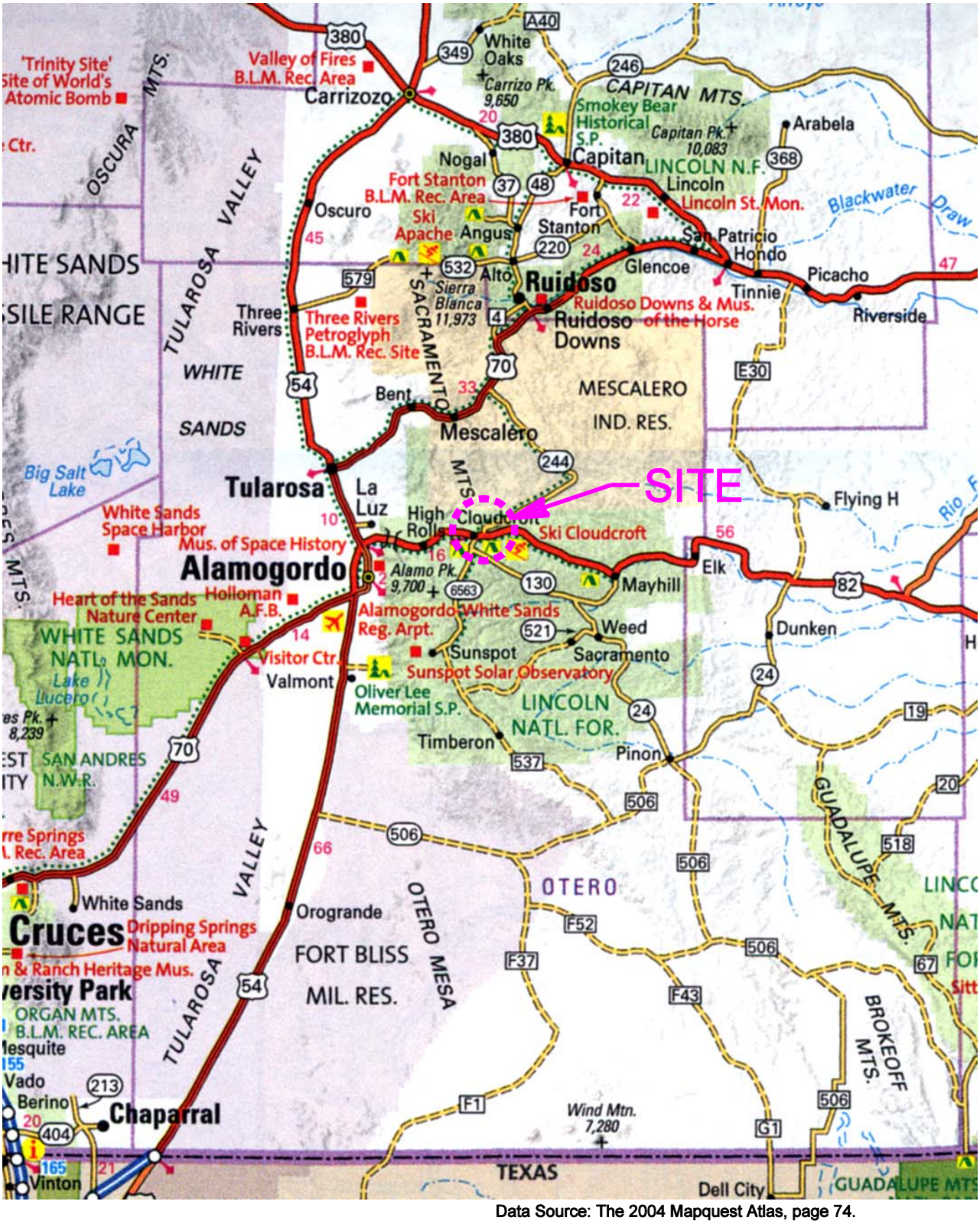
New Mexico Office of the State Engineer, 2004, Average Depth to Water Report, www.ose.state.nm.us

Ninyo & Moore, In-house proprietary information.

Uniform Plumbing Codes Handbook, 2000, McGraw Hill Handbooks.

United States Geological Survey, 1977, Cloudcroft, NM, 7.5 Minute Series (Topographic): Scale 1" = 24000'.

United States Geological Survey, 1999, National Seismic Hazard Mapping Project, World Wide Web, http://geohazards.cr.usgs.gov/eq.



Data Source: The 2004 Mapquest Atlas, page 74.

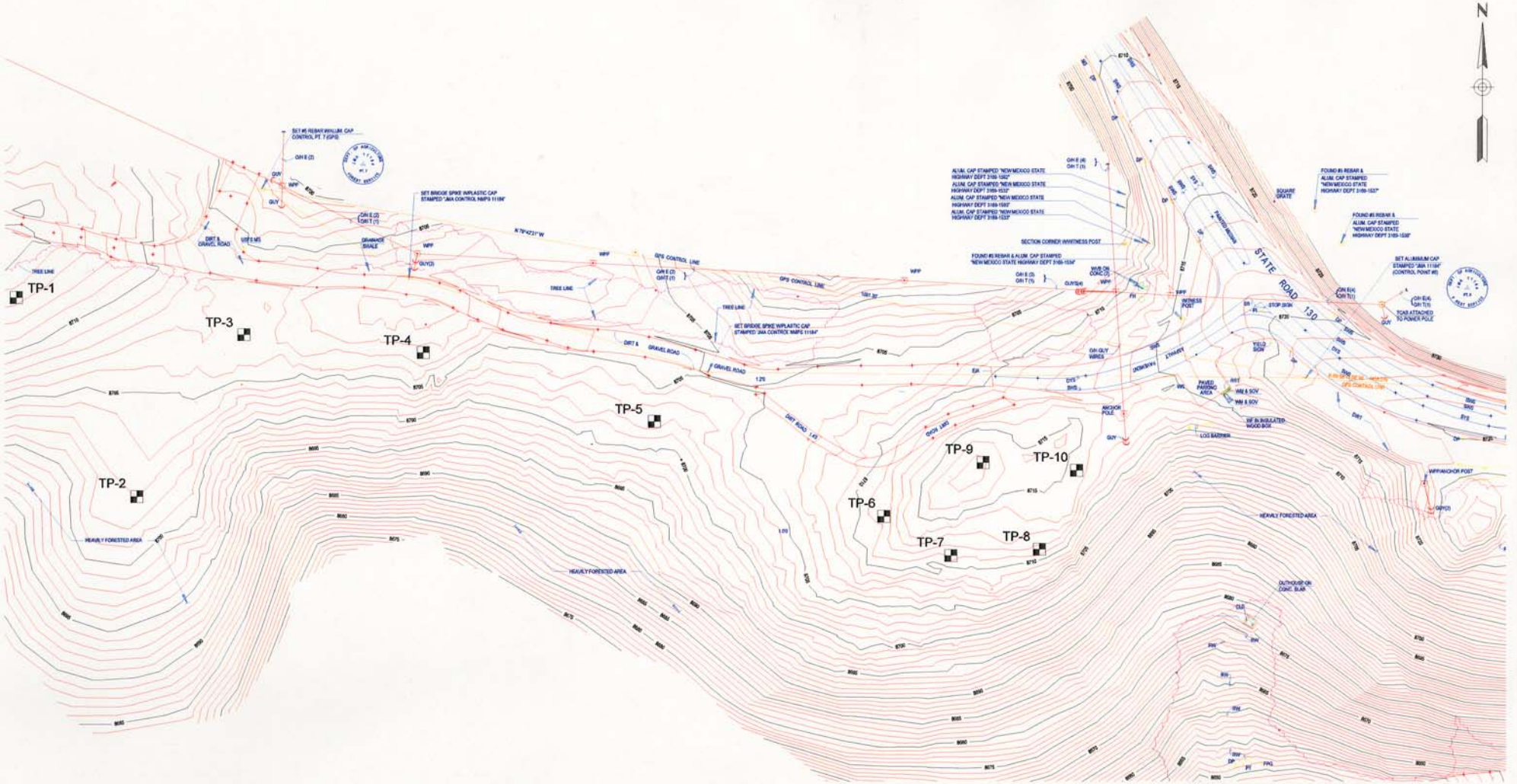
SITE LOCATION MAP

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

Ninyo & Moore

PROJECT NO.	DATE	FIGURE
600587004	12/04	1

g:\Drafting\600587004\600587004-SLM.dgn



TEST PIT LOCATION MAP

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

LEGEND

TP-10 PROPOSED TEST PIT LOCATION

Ninyo & Moore

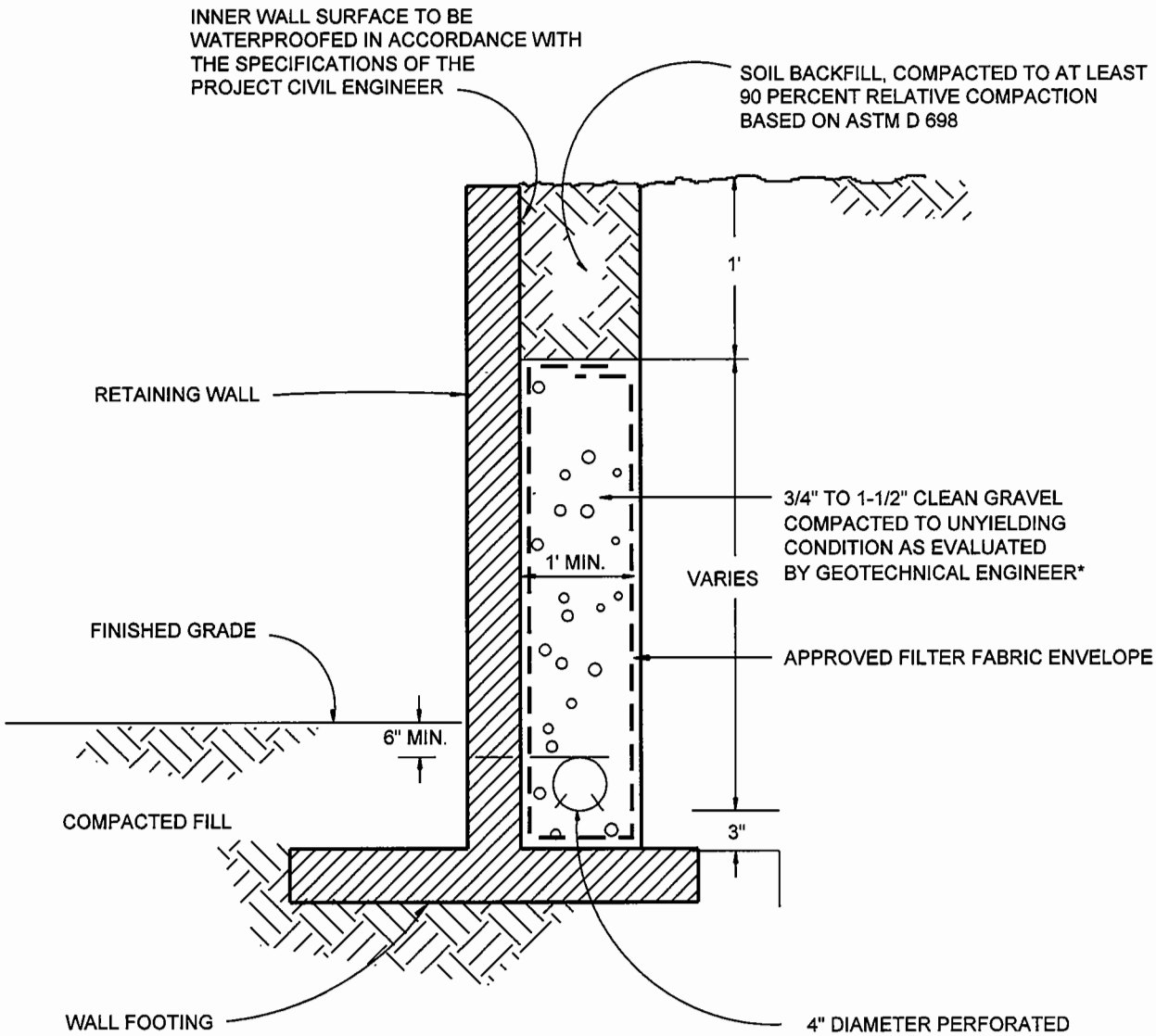
PROJECT NO.	DATE	FIGURE
600587004	12/04	2

g:\Drafting\600587004\600587004-BLM.dgn

...\600587004\600587004-BLM.dgn 1/3/2005 3:53:31 PM

PERMEABLE MATERIAL

SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	90-100
3/8"	40-100
No.4	25-40
No.8	18-33
No.30	5-15
No.50	0-7
No.200	0-3



* IF PERMEABLE MATERIAL (SEE GRADATION ABOVE) IS USED IN PLACE OF 3/4" TO 1-1/2" GRAVEL, FILTER FABRIC MAY BE DELETED. PERMEABLE MATERIAL SHOULD BE COMPACTED TO 90 PERCENT RELATIVE COMPACTION BASED ON ASTM D 698.

NOT TO SCALE

Ninyo & Moore

TYPICAL - RETAINING WALL DRAIN DETAIL

FIGURE 3

g:\Drafting\600770001\RetWall.dgn

APPENDIX A

TEST PIT LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory excavations. The samples were bagged and transported to the laboratory for testing.

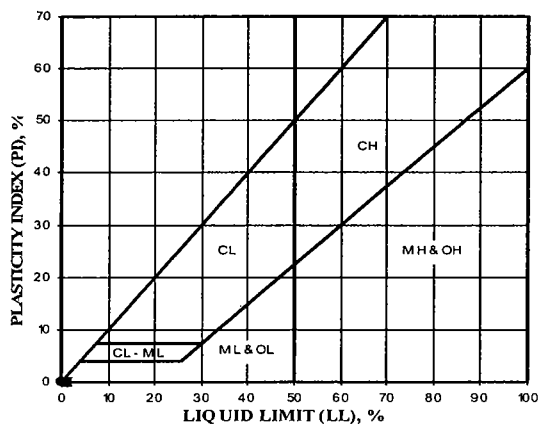
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	SILTS & CLAYS Liquid Limit <50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
Coarse	3" to 3/4"	76.2 to 19.1
Fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.075
Coarse	No. 4 to No. 10	4.76 to 2.00
Medium	No. 10 to No. 40	2.00 to 0.420
Fine	No. 40 to No. 200	0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

PLASTICITY CHART



Ninyo & Moore

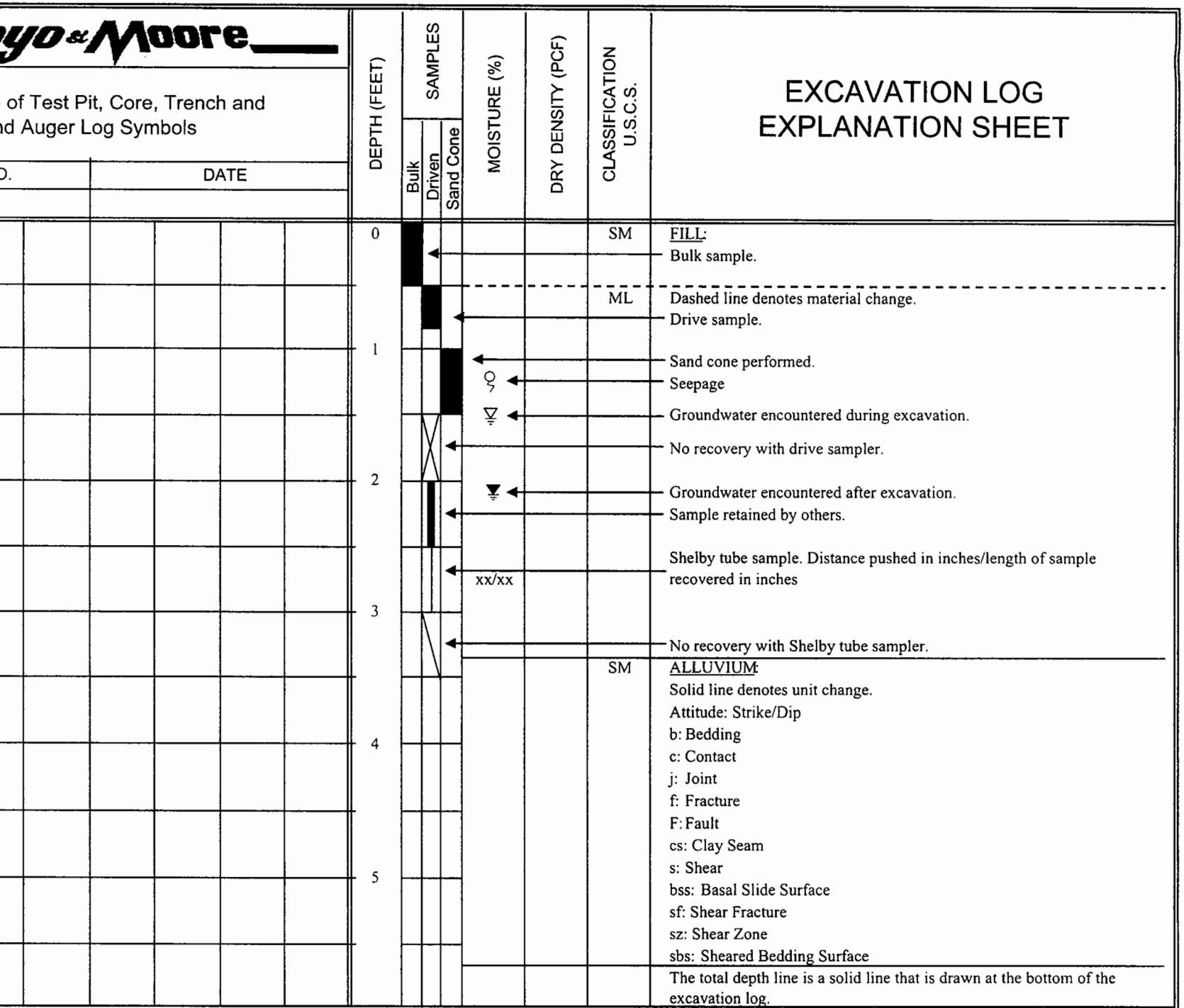
U.S.C.S. METHOD OF SOIL CLASSIFICATION

Ninyo & Moore

Explanation of Test Pit, Core, Trench and Hand Auger Log Symbols

PROJECT NO.	DATE

EXCAVATION LOG EXPLANATION SHEET



SCALE: 1 inch = 1 foot

FIGURE

Testpit explanation.xls

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

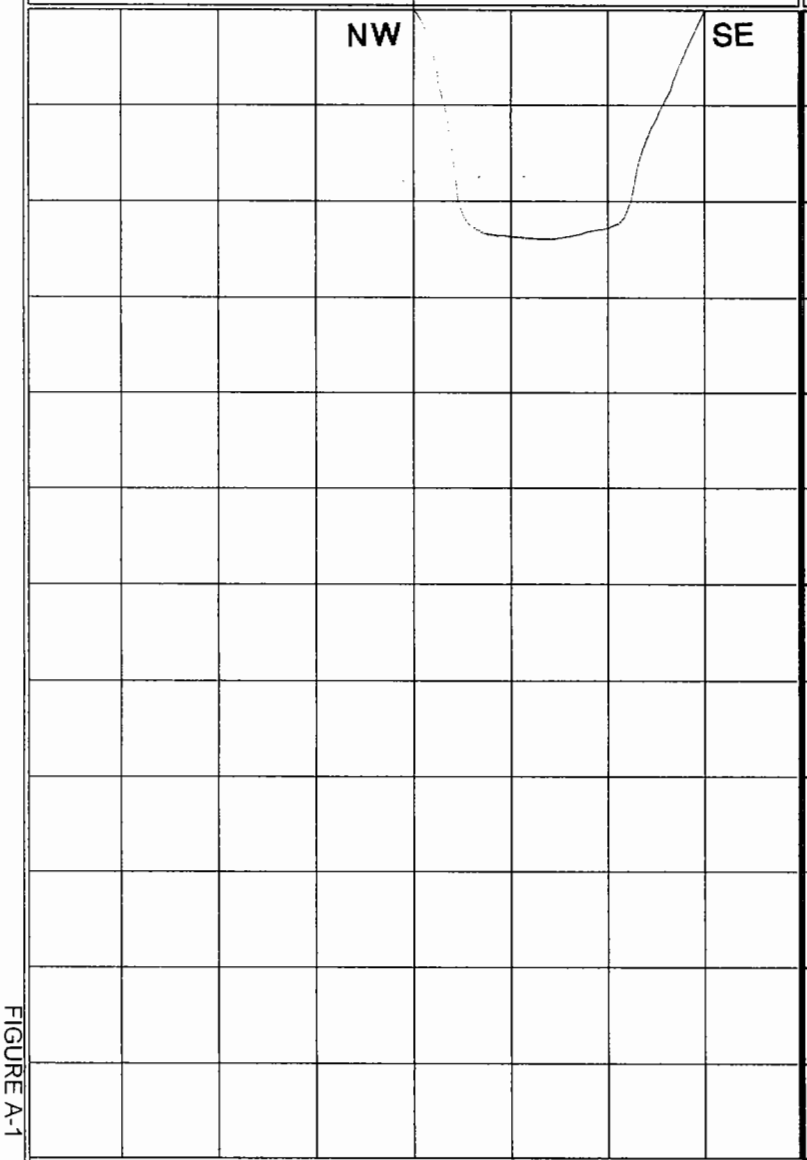
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-1

GROUND ELEVATION ± 8713' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			25.0		CL	RESIDUUM: Dark brown, damp, stiff, sandy CLAY; some cobbles; little silt.
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments. Total depth = 2.25 feet. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.

FIGURE A-1

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

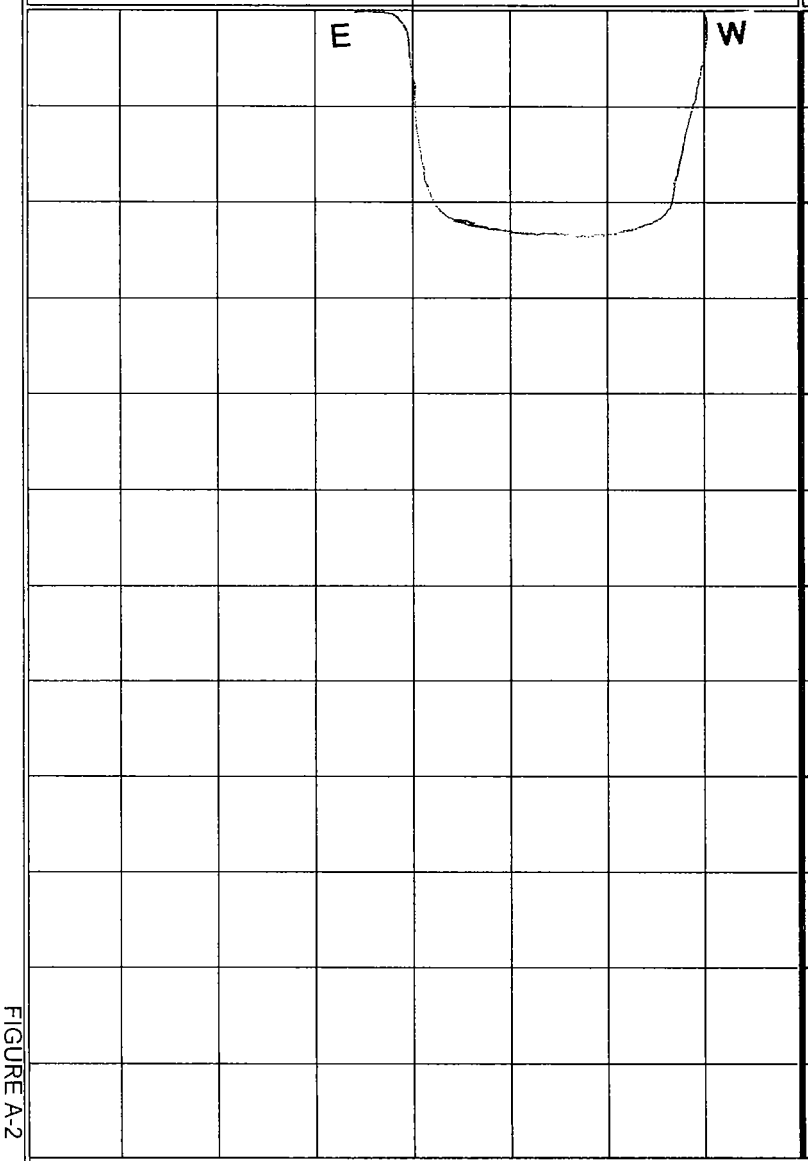
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-2

GROUND ELEVATION ± 8703' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			32.1		CL	RESIDUUM: Dark brown, damp, stiff, sandy CLAY; some cobbles; some silt.
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments.
							Total depth = 2.5 feet. (Refusal on limestone bedrock)
							Groundwater not encountered.
							Backfilled on 10/07/04.

FIGURE A-2

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

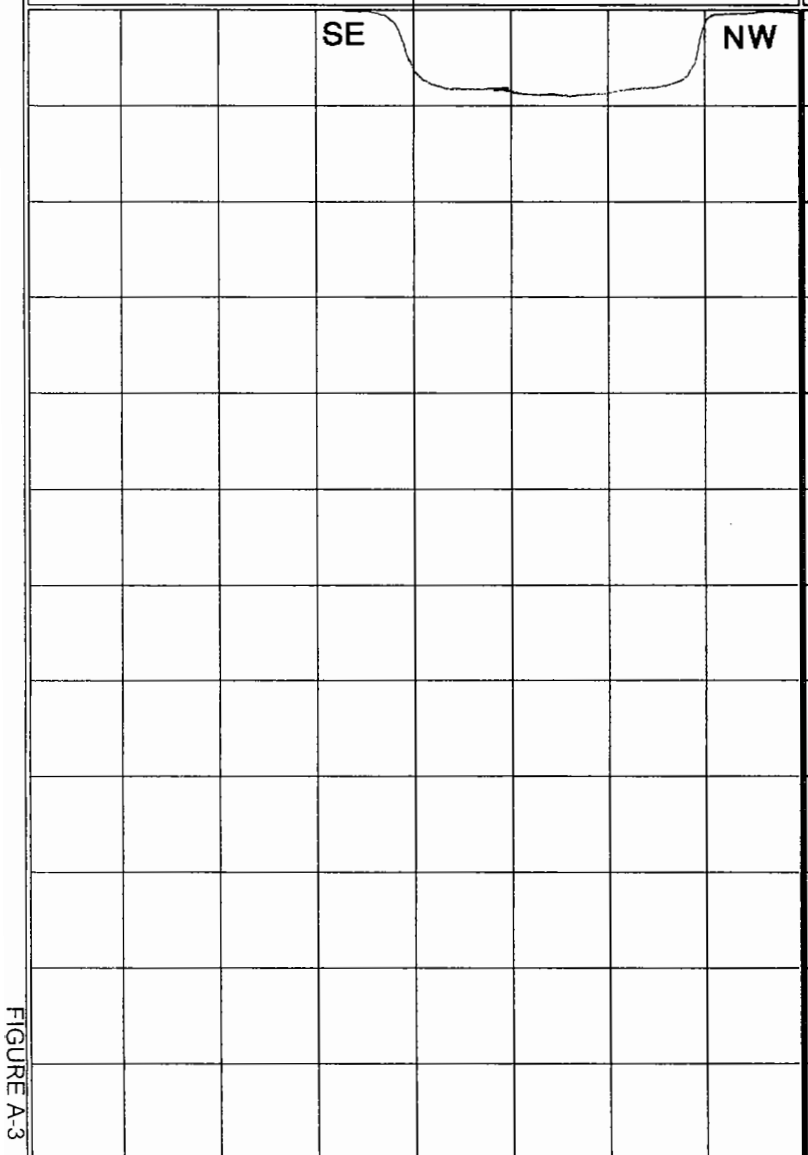
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-3

GROUND ELEVATION ± 8706' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			27.7		CL	RESIDUUM: Dark brown, damp, sandy CLAY; some cobbles; little silt.
							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments.
							Total depth = 0.9 feet. (Refusal on limestone bedrock)
							Groundwater not encountered.
							Backfilled on 10/07/04.

FIGURE A-3

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

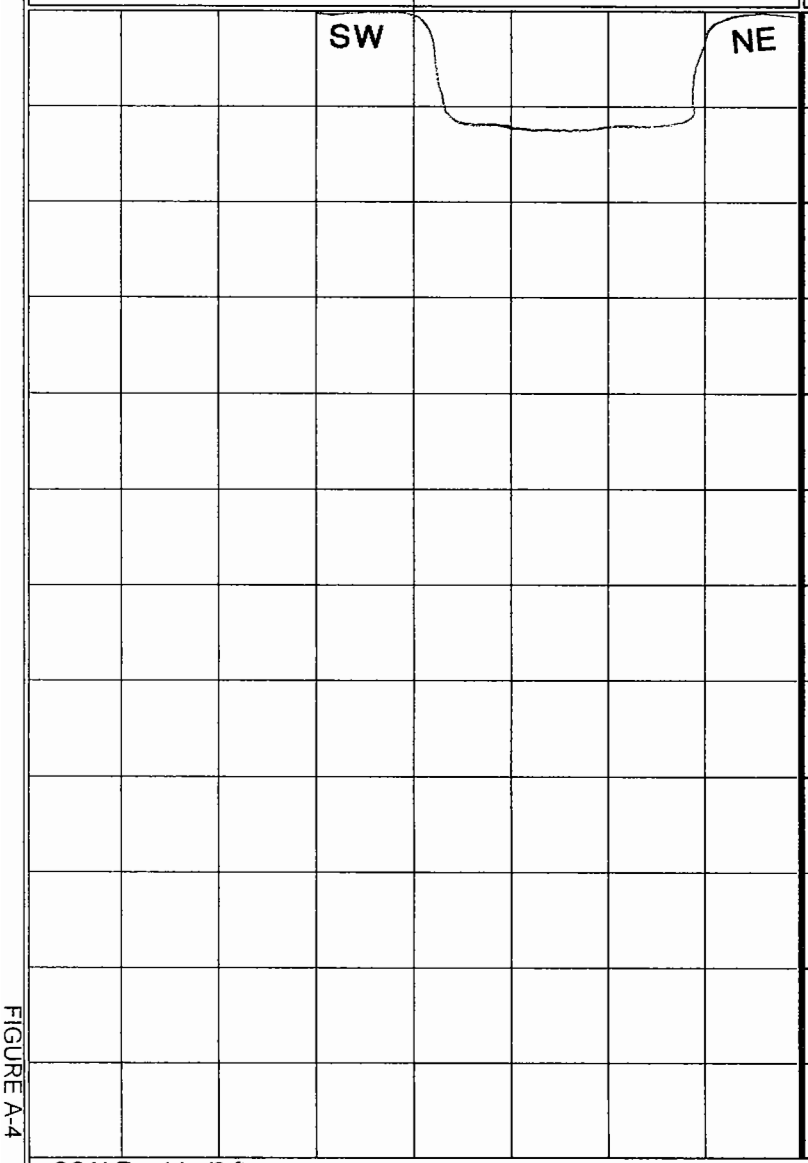
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-4

GROUND ELEVATION ± 8708' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			30.3		SM	RESIDUUM: Dark brown, medium dense, silty SAND; some clay; some cobbles.
							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments.
2							Total depth = 1.5 feet. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.

FIGURE A-4

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

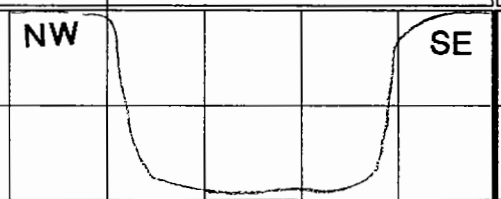
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-5

GROUND ELEVATION ± 8703' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						CL	TOPSOIL: Dark brown, damp, stiff, sandy CLAY; some silt; some cobbles.
	■			33.5			
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; few skeletal fragments. Total = 1.9 feet. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.
4							
6							
8							
10							
12							

SCALE = 1 in./2 ft.

FIGURE A-5

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

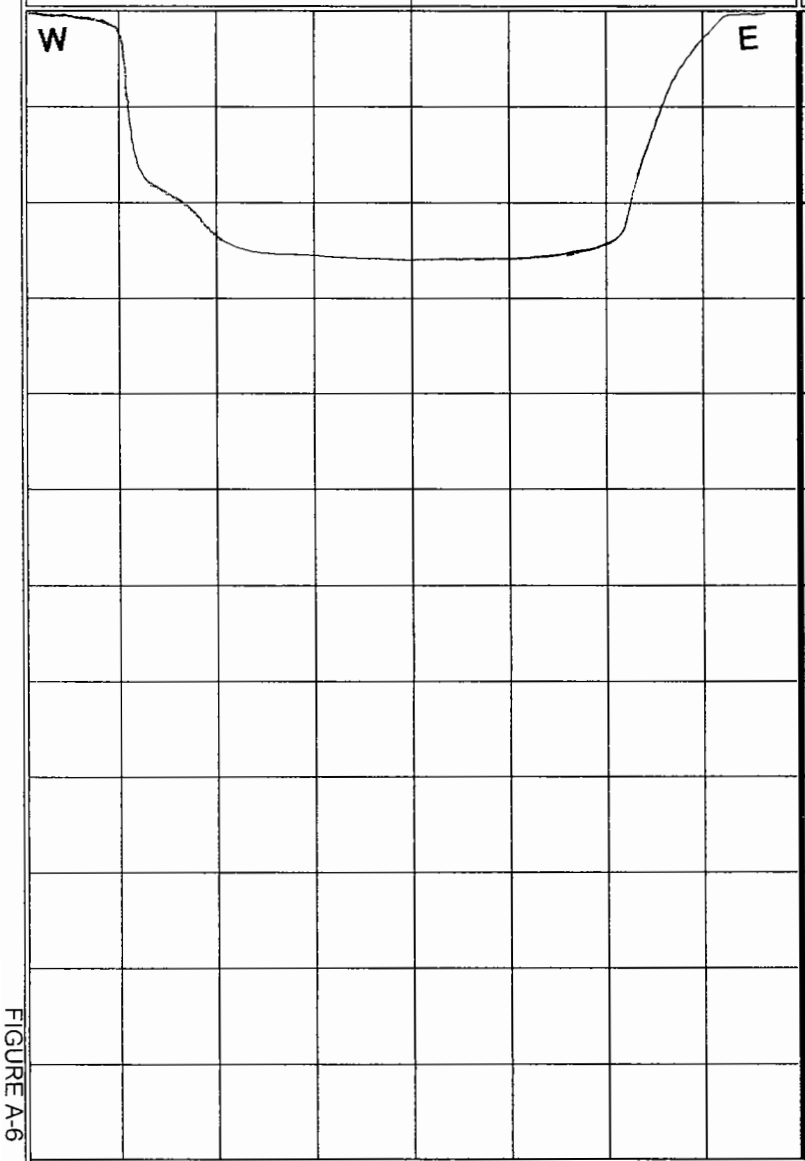
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-6

GROUND ELEVATION ± 8711' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			18.7		CL	RESIDUUM: Dark brown, damp, very dense, sandy CLAY; little silt; some cobbles.
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments. Total depth = 2.4 feet. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.

FIGURE A-6

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

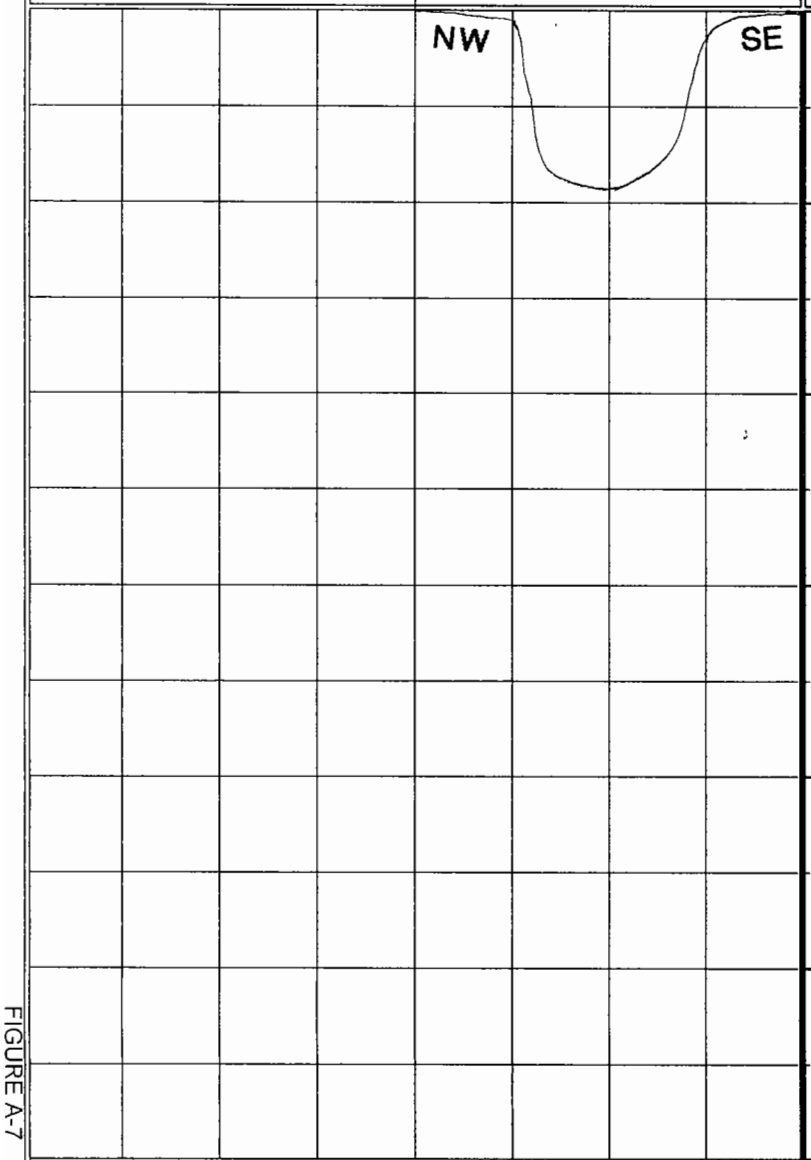
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-7

GROUND ELEVATION ± 8710' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			27.5		CL	RESIDUUM: Dark brown, damp, sandy CLAY; some cobbles; some silt.
						CL	Light brown, moist, stiff, sandy CLAY; some silt.
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments.
							Total depth = 1.9 feet. (Refusal on limestone bedrock)
							Groundwater not encountered.
							Backfilled on 10/07/04.
4							
6							
8							
10							
12							

FIGURE A-7

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

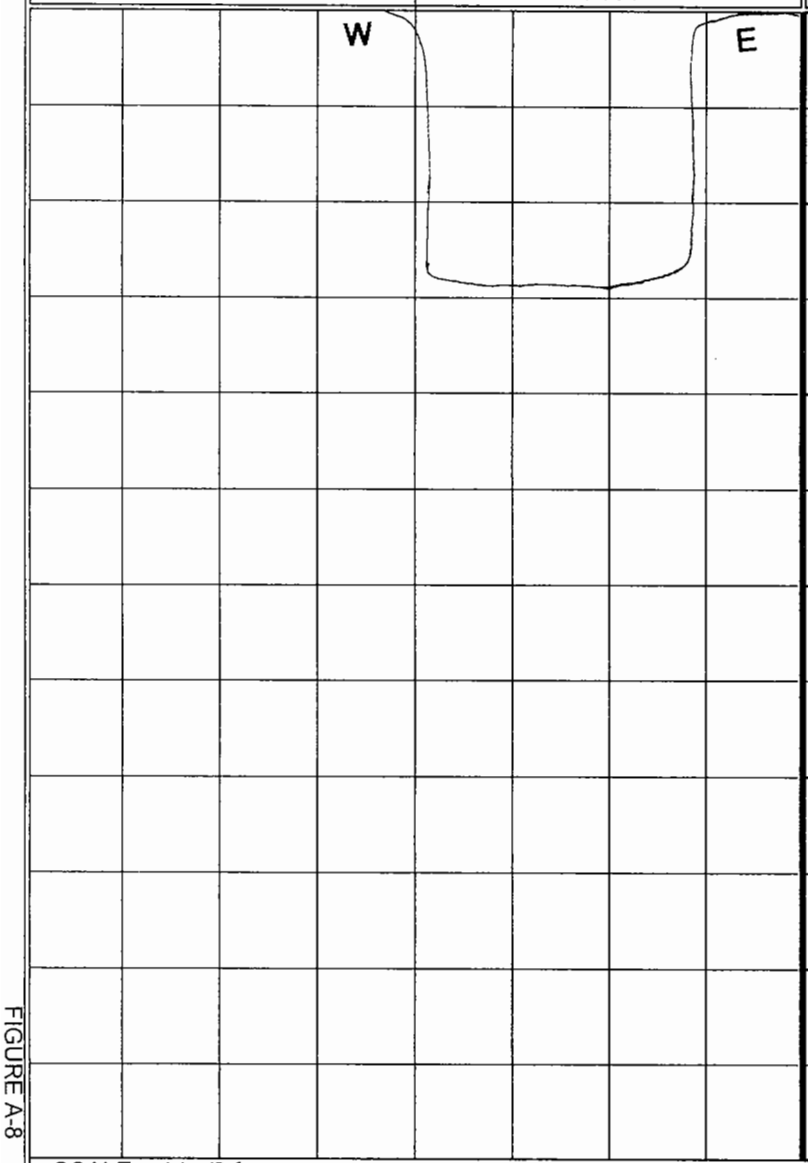
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-8

GROUND ELEVATION ± 8711' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			22.2		CL	TOPSOIL: Dark brown, damp, stiff, sandy CLAY; some silt; some cobbles.
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; few skeletal fragments.
4							Total depth = 2.92 feet. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.
6							
8							
10							
12							

SCALE = 1 in./2 ft.

FIGURE A-8

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

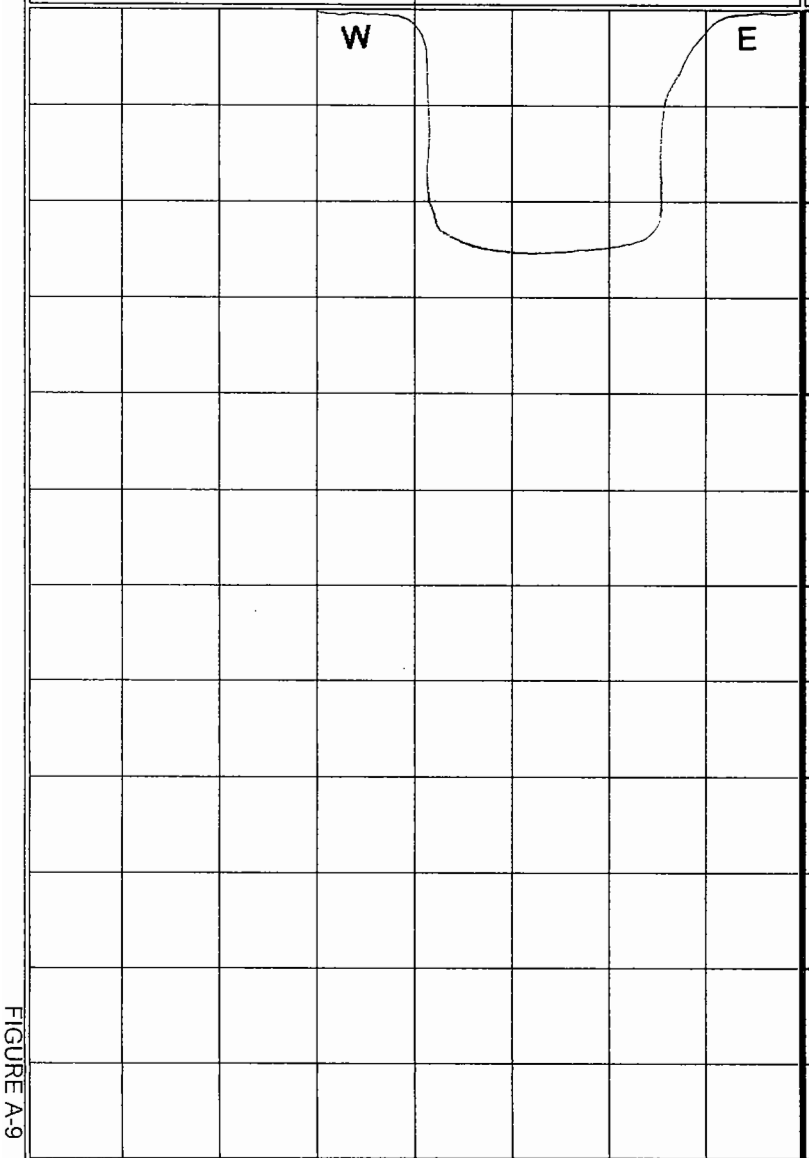
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-9

GROUND ELEVATION ± 8717' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0	■			20.6		SM	TOPSOIL: Dark brown, damp, medium dense, silty fine SAND; trace clay; some cobbles.
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; few skeletal fragments.
							Total depth = 2.5 foot. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.

SCALE = 1 in./2 ft.

FIGURE A-9

Ninyo & Moore

TEST PIT LOG

LOST LODGE ADMINISTRATION SITE
CLOUDCROFT, NEW MEXICO

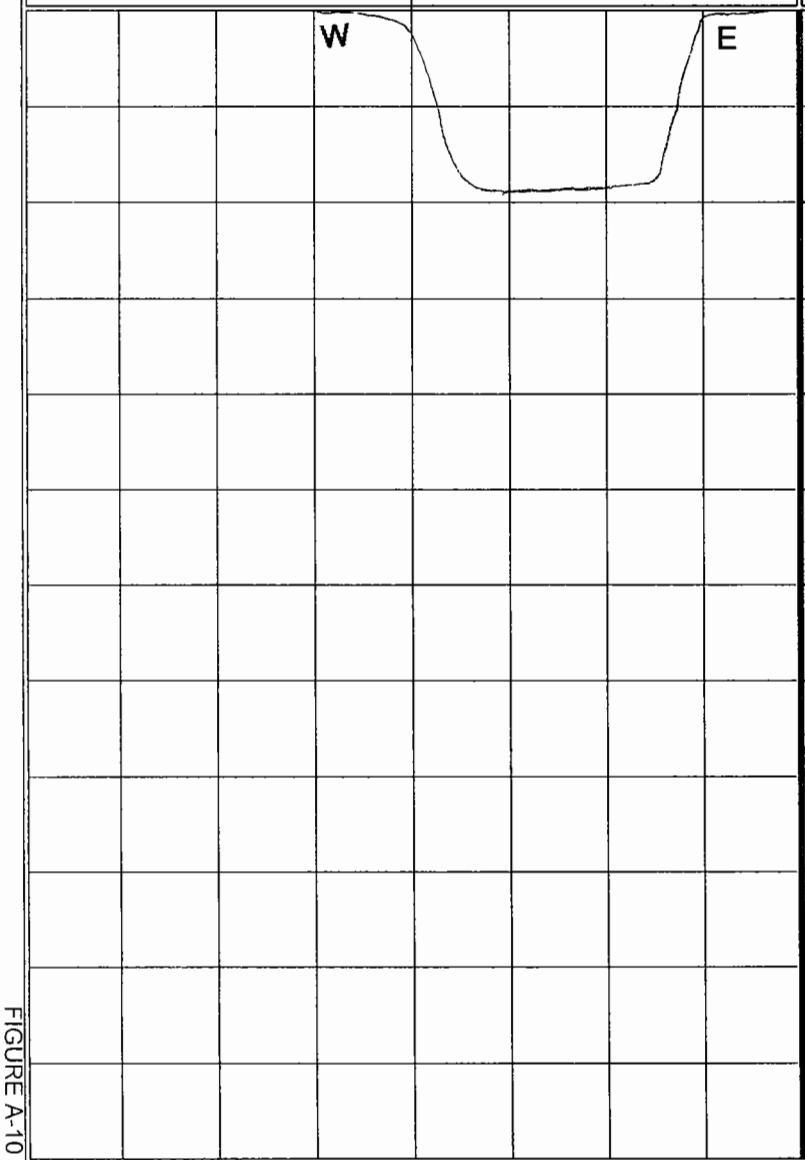
PROJECT NO.	DATE
600587004	12/04

DATE EXCAVATED 10/7/04 TEST PIT NO. TP-10

GROUND ELEVATION ± 8714' MSL LOGGED BY JSR

METHOD OF EXCAVATION Backhoe

LOCATION See Test Pit Location Map



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						CL	RESIDUUM: Dark brown, damp, stiff, sandy CLAY; some cobbles; little silt.
	■			19.2			
2							SAN ANDRES FORMATION: Dark gray, LIMESTONE; little skeletal fragments. Total depth = 1.9 feet. (Refusal on limestone bedrock) Groundwater not encountered. Backfilled on 10/07/04.

SCALE = 1 in./2 ft.

FIGURE A-10

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

Moisture Content

The moisture content of samples obtained from the exploratory excavations was evaluated in accordance with ASTM D 2216-98. The test results are presented on the logs of the exploratory excavations in Appendix A.

Organic Matter

The organic matter of samples obtained from the exploratory excavations was evaluated in accordance with the procedure outlined in Communications in Soil Science and Plant Analysis, Volume 15, page 759 though 772, Storer, 1984. The test results are presented on Figure B-1 in Appendix B.

SOIL ANALYSIS REPORT

SAMPLE LOCATION	SAMPLE DEPTH (FT)	ORGANIC MATTER %
TP-1	0 - 2.25	17
TP-5	0 - 0.5	16
TP-10	0 - 1.9	16

Ninyo & Moore

SOIL ANALYSIS REPORT

LOST LODGE ADMINISTRATION SITE
CLOUD CROFT, NEW MEXICO

PROJECT NO.	DATE	FIGURE
600587004	12/04	B-1

APPENDIX C

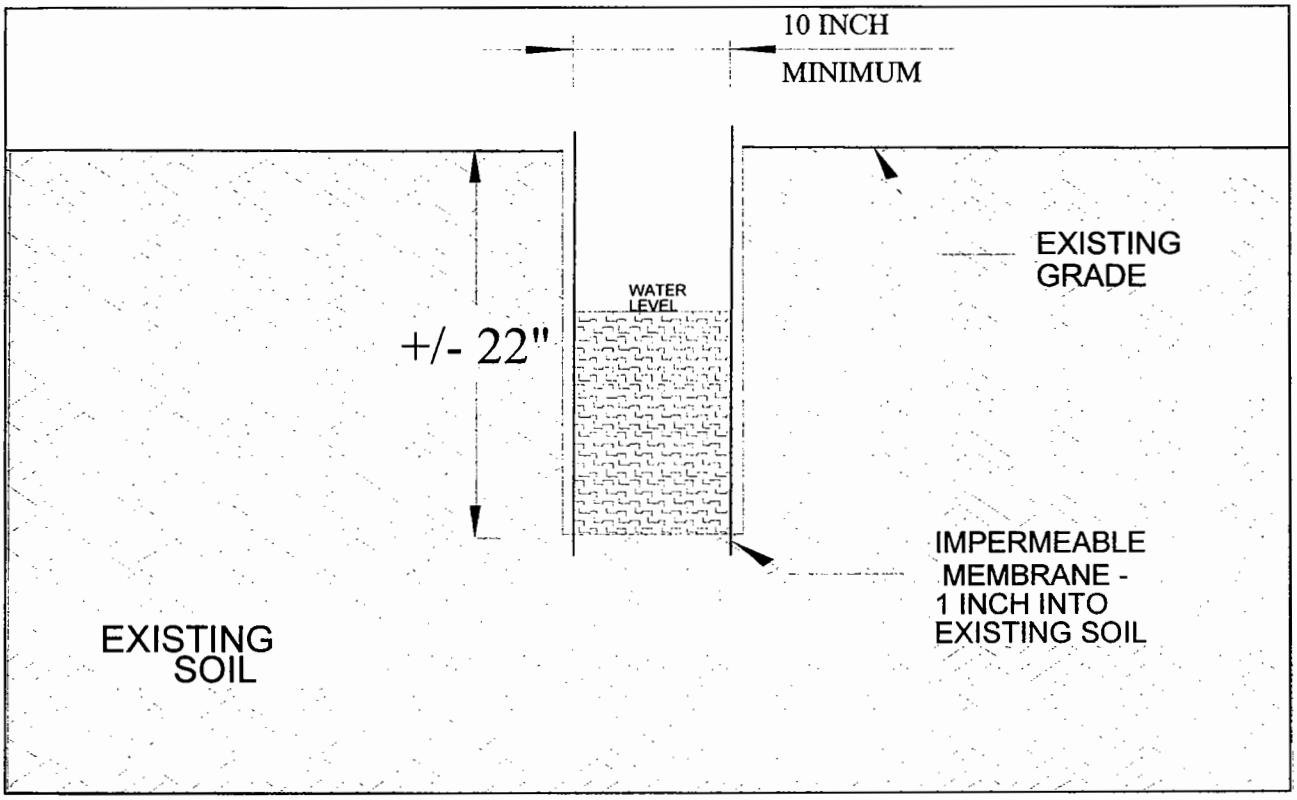
SUMMARY OF PERCOLATION TEST RESULTS

Ninyo & Moore

SUMMARY OF PERCOLATION TEST RESULTS

PROJECT: Lost Lodge Administration Site, Cloudcroft, New Mexico PROJECT NO.: 600587004

TECHNICIAN: JSR DATE: 10/07/04 LOCATION: Approximatly 10 feet southwest of TP-6



START TIME (Hr:Min)	ENDING TIME (Hr:Min)	ELAPSED TIME (Hrs)	INITIAL READING (Feet)	FINAL READING (Feet)	CHANGE IN WATER LEVEL (Feet)	PERCOLATION RATE*
12:10	12:11	0.017	1	1.33	0.33	19.80
12:11	12:12	0.017	1.33	1.375	0.045	2.70
12:12	12:13	0.017	1.375	1.416	0.041	2.46
12:13	12:14	0.017	1.416	1.458	0.042	2.52
12:14	12:15	0.017	1.458	1.5	0.042	2.52

* Note: Percolation rate is reported in feet per hour which is equivalent to cubic feet per hour per square foot of percolation area.

AVERAGE PERCOLATION RATE FOR LAST THREE READINGS	**2.50**	FT/HOUR

APPENDIX D

TYPICAL EARTHWORK GUIDELINES FOR CUT AND FILL GRADING

TABLE OF CONTENTS

TYPICAL EARTHWORK GUIDELINES FOR CUT AND FILL GRADING
(Slopes Less Than 10 Feet High)

1. GENERAL

These guidelines and the standard details attached hereto are presented as general procedures for earthwork construction for sites having slopes less than 10 feet high. They are to be utilized in conjunction with the project grading plans. These guidelines are considered a part of the geotechnical report, but are superseded by recommendations in the geotechnical report in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations which could supersede these specifications and/or the recommendations of the geotechnical report. It is the responsibility of the contractor to read and understand these guidelines as well as the geotechnical report and project grading plans.

1.1. The contractor shall not vary from these guidelines without prior recommendations by the geotechnical consultant and the approval of the client or the client's authorized representative. Recommendations by the geotechnical consultant and/or client shall not be considered to preclude requirements for approval by the jurisdictional agency prior to the execution of any changes.

1.2. The contractor shall perform the grading operations in accordance with these specifications, and shall be responsible for the quality of the finished product notwithstanding the fact that grading work will be observed and tested by the geotechnical consultant.

1.3. It is the responsibility of the grading contractor to notify the geotechnical consultant and the jurisdictional agencies, as needed, prior to the start of work at the site and at any time that grading resumes after interruption. Each step of the grading operations shall be observed and documented by the geotechnical consultant and, where needed, reviewed by the appropriate jurisdictional agency prior to proceeding with subsequent work.

1.4. If, during the grading operations, geotechnical conditions are encountered which were not anticipated or described in the geotechnical report, the geotechnical consultant shall be notified immediately and additional recommendations, if applicable, may be provided.

1.5. An as-graded report shall be prepared by the geotechnical consultant and signed by a registered engineer. The report documents the geotechnical consultants' observations, and field and laboratory test results, and provides conclusions

regarding whether or not earthwork construction was performed in accordance with the geotechnical recommendations and the grading plans. Recommendations for foundation design, pavement design, subgrade treatment, etc., may also be included in the as-graded report.

1.6. For the purpose of evaluating quantities of materials excavated during grading and/or locating the limits of excavations, a licensed land surveyor or civil engineer shall be retained.

1.7. Definitions of terms utilized in the remainder of these specifications have been provided in Section 11.

2. OBLIGATIONS OF PARTIES

The parties involved in the projects earthwork activities shall be responsible as outlined in the following sections.

2.1. The client is ultimately responsible for each of the aspects of the project. The client or the client's authorized representative has a responsibility to review the findings and recommendations of the geotechnical consultant. The client shall authorize the contractor and/or other consultants to perform work and/or provide services. During grading the client or the client's authorized representative shall remain on site or remain reasonably accessible to the concerned parties to make the decisions that may be needed to maintain the flow of the project.

2.2. The contractor is responsible for the safety of the project and satisfactory completion of grading and other associated operations, including, but not limited to, earthwork in accordance with the project plans, specifications, and jurisdictional agency requirements. During grading, the contractor or the contractor's authorized representative shall remain on site. The contractor shall further remain accessible during non-working hours, including at night and during days off.

2.3. The geotechnical consultant shall provide observation and testing services and shall make evaluations to advise the client on geotechnical matters. The geotechnical consultant shall report findings and recommendations to the client or the client's authorized representative.

2.4. Prior to proceeding with any grading operations, the geotechnical consultant shall be notified two working days in advance to schedule the needed observation and testing services.

2.5. Prior to any significant expansion or reduction in the grading operation, the geotechnical consultant shall be provided with two working days notice to make appropriate adjustments in scheduling of on-site personnel.

2.6. Between phases of grading operations, the geotechnical consultant shall be provided with two working days notice in advance of commencement of additional grading operations.

3. SITE PREPARATION

Site preparation shall be performed in accordance with the recommendations presented in the following sections.

3.1. The client, prior to any site preparation or grading, shall arrange and attend a pre-grading meeting between the grading contractor, the design engineer, the geotechnical consultant, and representatives of appropriate governing authorities, as well as any other involved parties. The parties shall be given two working days notice.

3.2. Clearing and grubbing shall consist of the substantial removal of vegetation, brush, grass, wood, stumps, trees, tree roots greater than 1/2-inch in diameter, and other deleterious materials from the areas to be graded. Clearing and grubbing shall extend to the outside of the proposed excavation and fill areas.

3.3. Demolition in the areas to be graded shall include removal of building structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, etc.), and other manmade surface and subsurface improvements, and the backfilling of mining shafts, tunnels and surface depressions. Demolition of utilities shall include capping or rerouting of pipelines at the project perimeter, and abandonment of wells in accordance with the requirements of the governing authorities and the recommendations of the geotechnical consultant at the time of demolition.

3.4. The debris generated during clearing, grubbing and/or demolition operations shall be removed from areas to be graded and disposed of off site at a legal dump site. Clearing, grubbing, and demolition operations shall be performed under the observation of the geotechnical consultant.

3.5. The ground surface beneath proposed fill areas shall be stripped of loose or unsuitable soil. These soils may be used as compacted fill provided they are generally free of organic or other deleterious materials and evaluated for use by the geotechnical consultant. The resulting surface shall be evaluated by the geotechnical consultant prior to proceeding. The cleared, natural ground surface shall

be scarified to a depth of approximately 8 inches, moisture conditioned, and compacted in accordance with the specifications presented in Section 5 of these guidelines.

4. REMOVALS AND EXCAVATIONS

Removals and excavations shall be performed as recommended in the following sections.

4.1. Removals

4.1.1. Materials which are considered unsuitable shall be excavated under the observation of the geotechnical consultant in accordance with the recommendations contained herein. Unsuitable materials include, but may not be limited to, dry, loose, soft, wet, organic, compressible natural soils, fractured, weathered, soft bedrock, and undocumented or otherwise deleterious fill materials.

4.1.2. Materials deemed by the geotechnical consultant to be unsatisfactory due to moisture conditions shall be excavated in accordance with the recommendations of the geotechnical consultant, watered or dried as needed, and mixed to a generally uniform moisture content in accordance with the specifications presented in Section 5 of this document.

4.2. Excavations

4.2.1. Temporary excavations no deeper than 5 feet in firm fill or natural materials may be made with vertical side slopes. To satisfy Occupational Safety and Health Administration (OSHA) requirements, any excavation deeper than 5 feet shall be shored or laid back at a 1:1 inclination or flatter, depending on material type, if construction workers are to enter the excavation.

5. COMPACTED FILL

Fill shall be constructed as specified below or by other methods recommended by the geotechnical consultant. Unless otherwise specified, fill soils shall be compacted to 95 percent or greater relative compaction, as evaluated in accordance with ASTM Test Method D 698-00.

5.1. Prior to placement of compacted fill, the contractor shall request an evaluation of the exposed ground surface by the geotechnical consultant. Unless otherwise recommended, the exposed ground surface shall then be scarified to a depth of approximately 9 inches and watered or dried, as needed, to achieve a generally uniform moisture content at or near the optimum moisture content. The scarified

materials shall then be compacted to 95 percent or greater relative compaction. The evaluation of compaction by the geotechnical consultant shall not be considered to preclude any requirements for observation or approval by governing agencies. It is the contractor's responsibility to notify the geotechnical consultant and the appropriate governing agency when project areas are ready for observation, and to provide reasonable time for that review.

5.2. Excavated on-site materials which are in general compliance with the recommendations of the geotechnical consultant may be utilized as compacted fill provided they are generally free of organic or other deleterious materials and do not contain rock fragments greater than 6 inches in dimension. During grading, the contractor may encounter soil types other than those analyzed during the preliminary geotechnical study. The geotechnical consultant shall be consulted to evaluate the suitability of any such soils for re-use as compacted fill.

5.3. Where imported materials are to be used on site, the geotechnical consultant shall be notified three working days in advance of importation in order that it may sample and test the materials from the proposed borrow sites. No imported materials shall be delivered for use on site without prior sampling, testing, and evaluation by the geotechnical consultant.

5.4. Soils imported for on-site use shall preferably have very low to low expansion potential (based on ASTM 4829-95 test procedures). Lots on which expansive soils may be exposed at grade shall be undercut 3 feet or more and capped with very low to low expansion potential fill. Details of the undercutting are provided in the Transition and Undercut Lot Details, Figure B of these guidelines. In the event expansive soils are present near the ground surface, special design and construction considerations shall be utilized in general accordance with the recommendations of the geotechnical consultant.

5.5. Fill materials shall be moisture conditioned to near optimum moisture content prior to placement. The optimum moisture content will vary with material type and other factors. Moisture conditioning of fill soils shall be generally uniform in the soil mass.

5.6 Prior to placement of additional compacted fill material following a delay in the grading operations, the exposed surface of previously compacted fill shall be prepared to receive fill. Preparation may include scarification, moisture conditioning, and recompaction.

5.7. Compacted fill shall be placed in horizontal lifts of approximately 8 inches in loose thickness. Prior to compaction, each lift shall be watered or dried as needed to achieve near optimum moisture condition, mixed, and then compacted by mechanical methods, using sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other appropriate compacting rollers, to the specified relative compac-

tion. Successive lifts shall be treated in a like manner until the desired finished grades are achieved.

5.8. Fill shall be tested in the field by the geotechnical consultant for evaluation of general compliance with the recommended relative compaction and moisture conditions. Field density testing shall conform to ASTM D 1556-00 (Sand Cone method), D 2937-00 (Drive-Cylinder method), and/or D 2922-96 and D 3017-96 (Nuclear Gauge method). Generally, one test shall be provided for approximately every 2 vertical feet of fill placed, or for approximately every 1000 cubic yards of fill placed. In addition, on slope faces one or more tests shall be taken for approximately every 10,000 square feet of slope face and/or approximately every 10 vertical feet of slope height. Actual test intervals may vary as field conditions dictate. Fill found to be out of conformance with the grading recommendations shall be removed, moisture conditioned, and compacted or otherwise handled to accomplish general compliance with the grading recommendations.

5.9. The contractor shall assist the geotechnical consultant by excavating suitable test pits for removal evaluation and/or for testing of compacted fill.

5.10. At the request of the geotechnical consultant, the contractor shall "shut down" or restrict grading equipment from operating in the area being tested to provide adequate testing time and safety for the field technician.

5.11. The geotechnical consultant shall maintain a map with the approximate locations of field density tests. Unless the client provides for surveying of the test locations, the locations shown by the geotechnical consultant will be estimated. The geotechnical consultant shall not be held responsible for the accuracy of the horizontal or vertical locations or elevations.

5.12. Grading operations shall be performed under the observation of the geotechnical consultant. Testing and evaluation by the geotechnical consultant does not preclude the need for approval by or other requirements of the jurisdictional agencies.

5.13. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When work is interrupted by heavy rains, the filling operation shall not be resumed until tests indicate that moisture content and density of the fill meet the project specifications. Regrading of the near-surface soil may be needed to achieve the specified moisture content and density.

5.14. Upon completion of grading and termination of observation by the geotechnical consultant, no further filling or excavating, including that planned for footings, foundations, retaining walls or other features, shall be performed without the involvement of the geotechnical consultant.

5.15. Fill placed in areas not previously viewed and evaluated by the geotechnical consultant may have to be removed and recompacted at the contractor's expense. The depth and extent of removal of the unobserved and undocumented fill will be decided based upon review of the field conditions by the geotechnical consultant.

5.16. Off-site fill shall be treated in the same manner as recommended in these specifications for on-site fills. Off-site fill subdrains temporarily terminated (up gradient) shall be surveyed for future locating and connection.

6. OVERSIZED MATERIAL

Oversized material shall be placed in accordance with the following recommendations.

6.1. During the course of grading operations, rocks or similar irreducible materials greater than 6 inches in dimension (oversized material) may be generated. These materials shall not be placed within the compacted fill unless placed in general accordance with the recommendations of the geotechnical consultant.

6.2. Where oversized rock (greater than 6 inches in dimension) or similar irreducible material is generated during grading, it is recommended, where practical, to waste such material off site, or on site in areas designated as "nonstructural rock disposal areas." Rock designated for disposal areas shall be placed with sufficient sandy soil to generally fill voids. The disposal area shall be capped with a 5-foot thickness of fill which is generally free of oversized material.

6.3. Rocks 6 inches in dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of rock is not permitted. Fill shall be placed and compacted over and around the rock. The amount of rock greater than 3/4-inch in dimension shall generally not exceed 40 percent of the total dry weight of the fill mass, unless the fill is specially designed and constructed as a "rock fill."

6.4. Rocks or similar irreducible materials greater than 6 inches but less than 4 feet in dimension generated during grading may be placed in windrows and capped with finer materials in accordance with the recommendations of the geotechnical consultant, the approval of the governing agencies, and the Oversized Rock Placement Detail, Figure D, of these guidelines. Selected native or imported granular soil (Sand Equivalent of 30 or higher) shall be placed and flooded over and around the windrowed rock such that voids are filled. Windrows of oversized materials shall be staggered so that successive windrows of oversized materials are not in the same vertical plane. Rocks greater than 4 feet in dimension shall be broken down to 4 feet or smaller before placement, or they shall be disposed of off site.

7. SLOPES

The following sections provide recommendations for cut and fill slopes.

7.1. Cut Slopes

7.1.1. The geotechnical consultant shall observe cut slopes during excavation. The geotechnical consultant shall be notified by the contractor prior to beginning slope excavations.

7.1.2. If, during the course of grading, adverse or potentially adverse geotechnical conditions are encountered in the slope which were not anticipated in the preliminary evaluation report, the geotechnical consultant shall evaluate the conditions and provide appropriate recommendations.

7.2. Fill Slopes

7.2.1. Fill slopes should generally be constructed in accordance with the illustrations shown on Fill Slope over Natural Ground or Cut, Figure A of these guidelines. When placing fill on slopes steeper than 5:1 (horizontal:vertical), topsoil, slope wash, colluvium, and other materials deemed unsuitable shall be removed. Near-horizontal keys and near-vertical benches shall be excavated into sound bedrock or firm fill material, in accordance with the recommendation of the geotechnical consultant. Keying and benching shall be accomplished. Compacted fill shall not be placed in an area subsequent to keying and benching until the area has been observed by the geotechnical consultant. Where the natural gradient of a slope is less than 5:1, benching is generally not recommended. However, fill shall not be placed on compressible or otherwise unsuitable materials left on the slope face.

7.2.2. Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a temporary slope, benching shall be conducted in the manner described in Section 7.2.1. A 3-foot or higher near-vertical bench shall be excavated into the documented fill prior to placement of additional fill.

7.2.3. Unless otherwise recommended by the geotechnical consultant and accepted by the Building Official, permanent fill slopes shall not be steeper than 2:1 (horizontal:vertical). The height of a fill slope shall be evaluated by the geotechnical consultant.

7.2.4. Unless specifically recommended otherwise, compacted fill slopes shall be overbuilt and cut back to grade, exposing firm compacted fill. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes shall be overexcavated and reconstructed in accordance with the recommendations of the geotechnical consultant. The degree of overbuilding

may be increased until the desired compacted slope face condition is achieved. Care shall be taken by the contractor to provide mechanical compaction as close to the outer edge of the overbuilt slope surface as practical.

7.2.5. If access restrictions, property line location, or other constraints limit over-building and cutting back of the slope face, an alternative method for compaction of the slope face may be attempted by conventional construction procedures including backrolling at intervals of 4 feet or less in vertical slope height, or as dictated by the capability of the available equipment, whichever is less. Fill slopes shall be back-rolled utilizing a conventional sheeps foot-type roller. Care shall be taken to maintain the specified moisture conditions and/or reestablish the same, as needed, prior to backrolling.

7.2.6. The placement, moisture conditioning and compaction of fill slope materials shall be done in accordance with the recommendations presented in Section 5 of these guidelines.

7.2.7. The contractor shall be ultimately responsible for placing and compacting the soil out to the slope face to obtain a relative compaction of 95 percent or greater as evaluated by ASTM D 698-00 and a moisture content in accordance with Section 5. The geotechnical consultant shall perform field moisture and density tests at intervals of one test for approximately every 10,000 square feet of slope.

7.2.8. Backdrains shall be provided in fill as recommended by the geotechnical consultant.

7.2.9. Fill shall be compacted prior to placement of survey stakes. This is particularly important on fill slopes. Slope stakes shall not be placed until the slope is compacted and tested. If a slope face fill does not meet the recommendations presented in this specification, it shall be recognized that stakes placed prior to completion of the recompaction effort will be removed and/or demolished at such time as the compaction procedures resume.

7.3. Top-of-Slope Drainage

7.3.1. For pad areas above slopes, positive drainage shall be established away from the top of slope. This may be accomplished utilizing a berm and pad gradient of 2 percent or steeper at the top-of-slope areas. Site runoff shall not be permitted to flow over the tops of slopes.

7.3.2. Gunite-lined brow ditches shall be placed at the top of cut slopes to redirect surface runoff away from the slope face where drainage devices are not otherwise provided.

7.4. Slope Maintenance

7.4.1. In order to enhance surficial slope stability, slope planting shall be accomplished at the completion of grading. Slope plants shall consist of deep-rooting, variable root depth, drought-tolerant vegetation. Native vegetation is generally desirable. Plants native to semiarid and arid areas may also be appropriate. A landscape architect shall be consulted regarding the actual types of plants and planting configuration to be used.

7.4.2. Irrigation pipes shall be anchored to slope faces and not placed in trenches excavated into slope faces. Slope irrigation shall be maintained at a level just sufficient to support plant growth. Property owners shall be made aware that over watering of slopes is detrimental to slope stability. Slopes shall be monitored regularly and broken sprinkler heads and/or pipes shall be repaired immediately.

7.4.3. Periodic observation of landscaped slope areas shall be planned and appropriate measures taken to enhance growth of landscape plants.

7.4.4. Graded swales at the top of slopes and terrace drains shall be installed and the property owners notified that the drains shall be periodically checked so that they may be kept clear. Damage to drainage improvements shall be repaired immediately. To reduce siltation, terrace drains shall be constructed at a gradient of 3 percent or steeper, in accordance with the recommendations of the project civil engineer.

7.4.5. If slope failures occur, the geotechnical consultant shall be contacted immediately for field review of site conditions and development of recommendations for evaluation and repair.

8. TRENCH BACKFILL

The following sections provide recommendations for backfilling of trenches.

8.1. Trench backfill shall consist of granular soils (bedding) extending from the trench bottom to 1 foot or more above the pipe. On-site or imported fill which has been evaluated by the geotechnical consultant may be used above the granular backfill. The cover soils directly in contact with the pipe shall be classified as having a very low expansion potential, in accordance with UBC Standard 18-2, and shall contain no rocks or chunks of hard soil larger than 3/4-inch in diameter.

8.2. Trench backfill shall, unless otherwise recommended, be compacted by mechanical means to 95 percent relative compaction or greater as evaluated by ASTM D 698-00. Backfill soils shall be placed in loose lifts 8-inches thick or thinner, moisture conditioned, and compacted in accordance with the recommendations of Section 5. of these guidelines. The backfill shall be tested by the geotechnical consultant at vertical intervals of approximately 2 feet of backfill placed and at spacings along the trench of approximately 100 feet in the same lift.

8.3. Jetting of trench backfill materials is generally not a recommended method of densification, unless the on-site soils are sufficiently free-draining and provisions have been made for adequate dissipation of the water utilized in the jetting process.

8.4. If it is decided that jetting may be utilized, granular material with a sand equivalent greater than 30 shall be used for backfilling in the areas to be jetted. Jetting shall generally be considered for trenches 2 feet or narrower in width and 4 feet or shallower in depth. Following jetting operations, trench backfill shall be mechanically compacted to the specified compaction to finish grade.

8.5. Trench backfill which underlies the zone of influence of foundations shall be mechanically compacted to 95 percent or greater relative compaction, as evaluated by ASTM D 698-00. The zone of influence of the foundations is generally defined as the roughly triangular area within the limits of a 1:1 projection from the inner and outer edges of the foundation, projected down and out from both edges.

8.6. Trench backfill within slab areas shall be compacted by mechanical means to a relative compaction of 95 percent or greater, as evaluated by ASTM D 698-00. For minor interior trenches, density testing may be omitted or spot testing may be performed, as deemed appropriate by the geotechnical consultant.

8.7. When compacting soil in close proximity to utilities, care shall be taken by the grading contractor so that mechanical methods used to compact the soils do not damage the utilities. If the utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, then the grading contractor may elect to use light mechanical compaction equipment or, with the approval of the geotechnical consultant, cover the conduit with clean granular material. These granular materials shall be jetted in place to the top of the conduit in accordance with the recommendations of Section 8.4 prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review by the geotechnical consultant and the utility contractor, at the time of construction.

8.8. Clean granular backfill and/or bedding materials are not recommended for use in slope areas unless provisions are made for a drainage system to mitigate the potential for buildup of seepage forces or piping of backfill materials.

8.9. The contractor shall exercise the specified safety precautions, in accordance with OSHA Trench Safety Regulations, while conducting trenching operations. Such precautions include shoring or laying back trench excavations at 1:1 or flatter, depending on material type, for trenches in excess of 5 feet in depth. The geotechnical consultant is not responsible for the safety of trench operations or stability of the trenches.

9. DRAINAGE

The following sections provide recommendations pertaining to site drainage.

9.1. Roof, pad, and slope drainage shall be such that it is away from slopes and structures to suitable discharge areas by nonerodible devices (e.g., gutters, downspouts, concrete swales, etc.).

9.2. Positive drainage adjacent to structures shall be established and maintained. Positive drainage may be accomplished by providing drainage away from the foundations of the structure at a gradient of 2 percent or steeper for a distance of 5 feet or more outside the building perimeter, further maintained by a graded swale leading to an appropriate outlet, in accordance with the recommendations of the project civil engineer and/or landscape architect.

9.3. Surface drainage on the site shall be provided so that water is not permitted to pond. A gradient of 2 percent or steeper shall be maintained over the pad area and drainage patterns shall be established to remove water from the site to an appropriate outlet.

9.4. Care shall be taken by the contractor during grading to preserve any berms, drainage terraces, interceptor swales or other drainage devices of a permanent nature on or adjacent to the property. Drainage patterns established at the time of finish grading shall be maintained for the life of the project. Property owners shall be made very clearly aware that altering drainage patterns may be detrimental to slope stability and foundation performance.

10. SITE PROTECTION

The site shall be protected as outlined in the following sections.

10.1. Protection of the site during the period of grading shall be the responsibility of the contractor unless other provisions are made in writing and agreed upon among the concerned parties. Completion of a portion of the project shall not be considered to preclude that portion or adjacent areas from the need for site protection, until such time as the project is finished as agreed upon by the geotechnical consultant, the client, and the regulatory agency.

10.2. The contractor is responsible for the stability of temporary excavations. Recommendations by the geotechnical consultant pertaining to temporary excavations are made in consideration of stability of the finished project and, therefore, shall not be considered to preclude the responsibilities of the contractor. Recommendations by the geotechnical consultant shall also not be considered to preclude more restrictive requirements by the applicable regulatory agencies.

10.3. Precautions shall be taken during the performance of site clearing, excavation, and grading to protect the site from flooding, ponding, or inundation by surface runoff. Temporary provisions shall be made during the rainy season so that surface runoff is away from and off the working site. Where low areas cannot be avoided, pumps shall be provided to remove water as needed during periods of rainfall.

10.4. During periods of rainfall, plastic sheeting shall be used as needed to reduce the potential for unprotected slopes to become saturated. Where needed, the contractor shall install check dams, desilting basins, riprap, sandbags or other appropriate devices or methods to reduce erosion and provide recommended conditions during inclement weather.

10.5. During periods of rainfall, the geotechnical consultant shall be kept informed by the contractor of the nature of remedial or precautionary work being performed on site (e.g., pumping, placement of sandbags or plastic sheeting, other labor, dozing, etc.).

10.6. Following periods of rainfall, the contractor shall contact the geotechnical consultant and arrange a walk-over of the site in order to visually assess rain-related damage. The geotechnical consultant may also recommend excavation and testing in order to aid in the evaluation. At the request of the geotechnical consultant, the contractor shall make excavations in order to aid in evaluation of the extent of rain-related damage.

10.7. Rain- or irrigation-related damage shall be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress, and other adverse conditions noted by the geotechnical consultant. Soil adversely affected shall be classified as "Unsuitable Material" and shall be subject to overexcavation and replacement with compacted fill or to other remedial grading as recommended by the geotechnical consultant.

10.8. Relatively level areas where saturated soils and/or erosion gullies exist to depths greater than 1 foot shall be overexcavated to competent materials as evaluated by the geotechnical consultant. Where adverse conditions extend to less than 1 foot in depth, saturated and/or eroded materials may be processed in-place. Overexcavated or in-place processed materials shall be moisture conditioned and compacted in accordance with the recommendations provided in Section 5. If the desired results are not achieved, the affected materials shall be overexcavated, moisture conditioned, and compacted until the specifications are met.

10.9. Slope areas where saturated soil and/or erosion gullies exist to depths greater than 1 foot shall be overexcavated and replaced as compacted fill in accordance with the applicable specifications. Where adversely affected materials exist to depths of 1 foot or less below proposed finished grade, remedial grading by moisture

conditioning in-place and compaction in accordance with the appropriate specifications may be attempted. If the desired results are not achieved, the affected materials shall be overexcavated, moisture conditioned, and compacted until the specifications are met. As conditions dictate, other slope repair procedures may also be recommended by the geotechnical consultant.

10.11. During construction, the contractor shall grade the site to provide positive drainage away from structures and to keep water from ponding adjacent to structures. Water shall not be allowed to damage adjacent properties. Positive drainage shall be maintained by the contractor until permanent drainage and erosion reducing devices are installed in accordance with project plans.

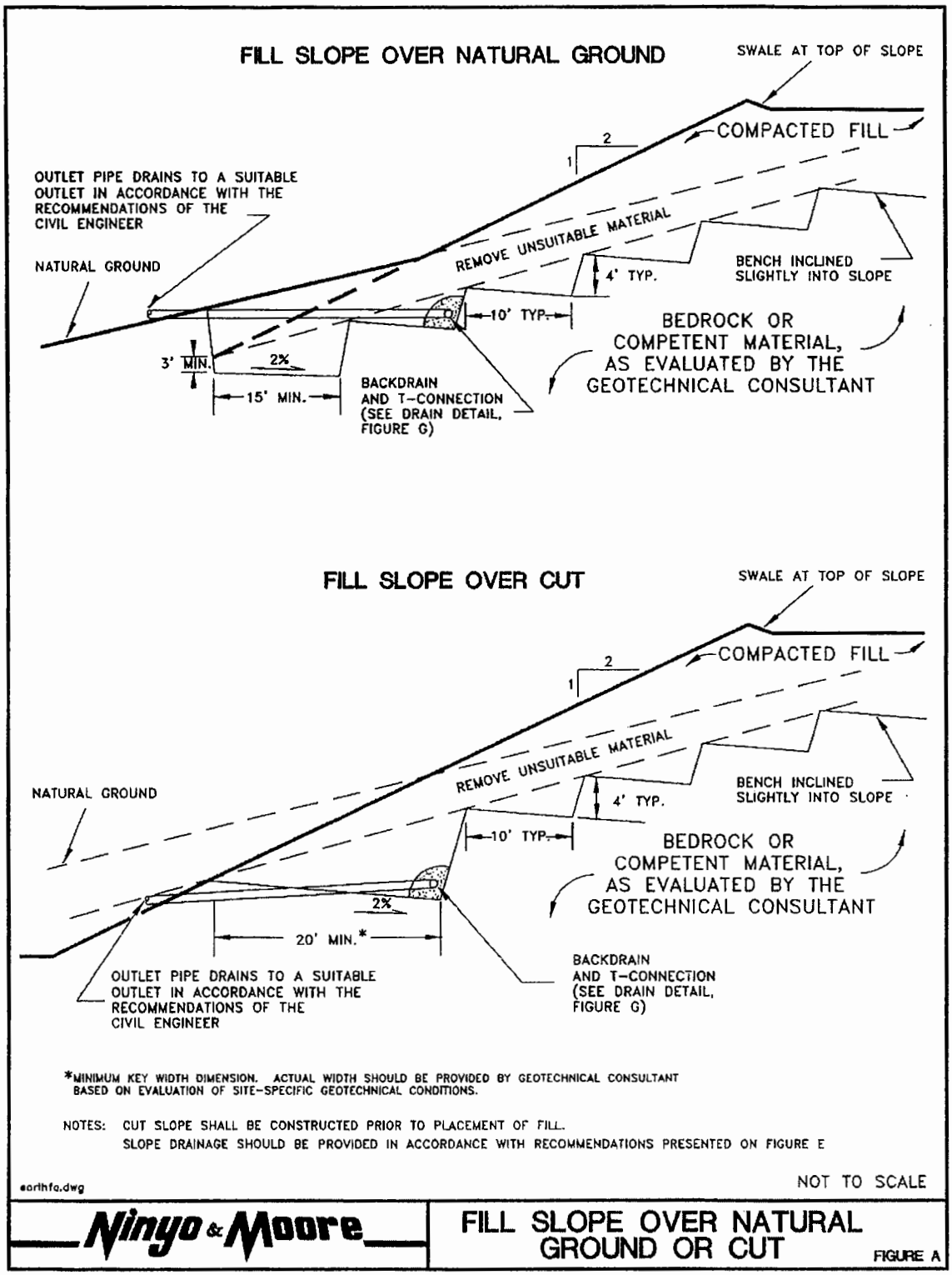
11. DEFINITIONS OF TERMS

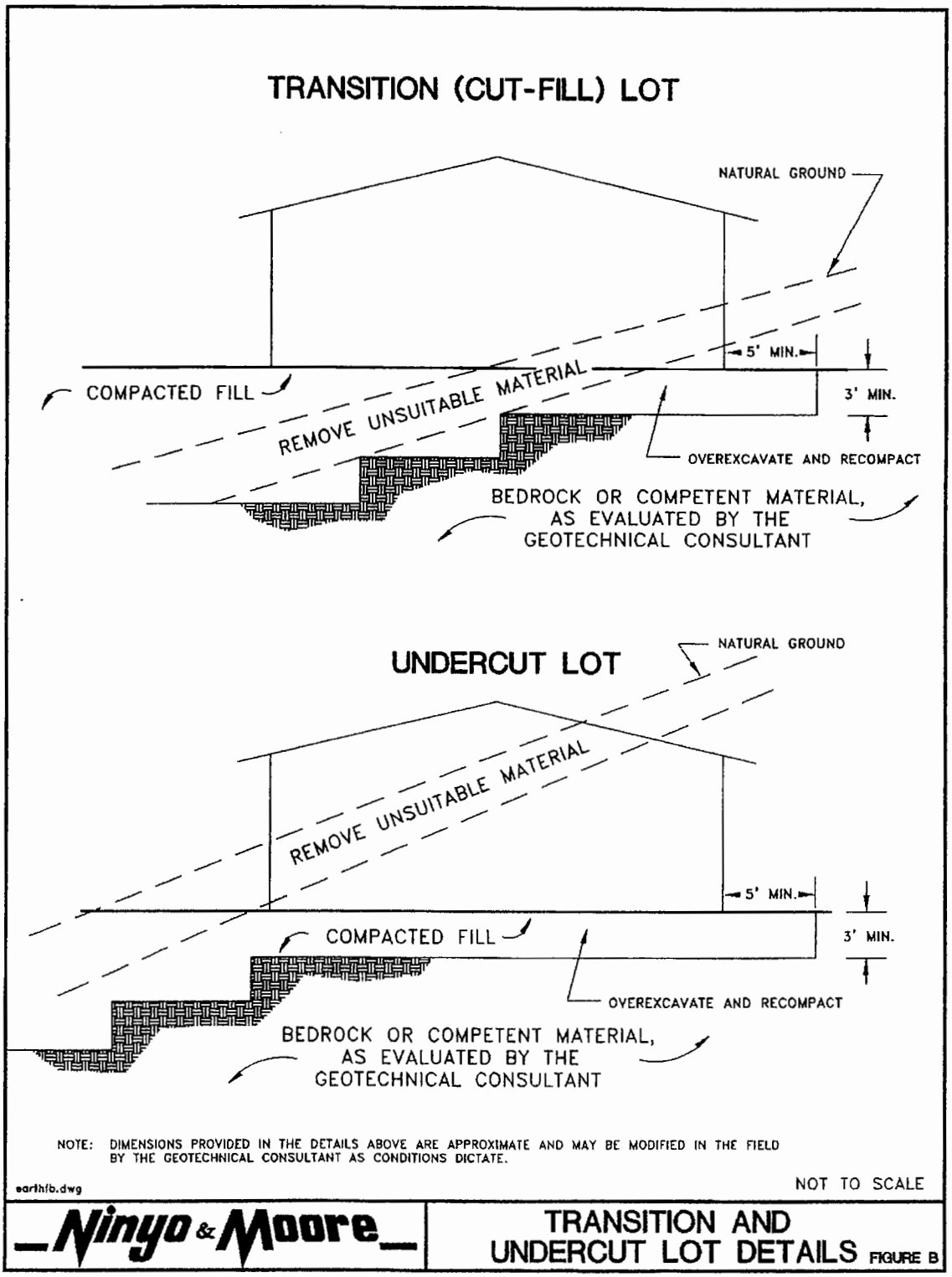
ALLUVIUM:	Unconsolidated detrital deposits deposited by flowing water; includes sediments deposited in river beds, canyons, flood plains, lakes, fans at the foot of slopes, and in estuaries.
AS-GRADED (AS-BUILT):	The site conditions upon completion of grading.
BACKCUT:	A temporary construction slope at the rear of earth-retaining structures such as buttresses, shear keys, stabilization fills, or retaining walls.
BACKDRAIN:	Generally a pipe-and-gravel or similar drainage system placed behind earth-retaining structures such as buttresses, stabilization fills, and retaining walls.
BEDROCK:	Relatively undisturbed in-place rock, either at the surface or beneath surficial deposits of soil.
BENCH:	A relatively level step and near-vertical riser excavated into sloping ground on which fill is to be placed.
BORROW (IMPORT):	Any fill material hauled to the project site from off-site areas.
BUTTRESS FILL:	A fill mass, the configuration of which is designed by engineering calculations, to retain slopes containing adverse geologic features. A buttress is generally specified by a key width and depth and by a backcut angle. A buttress normally contains a back drainage system.
CIVIL ENGINEER:	The Registered Civil Engineer or consulting firm responsible for preparation of the grading plans and surveying, and evaluating as-graded topographic conditions.
CLIENT:	The developer or a project-responsible authorized representative. The client has the responsibility of reviewing the findings and recommendations made by the geotechnical consultant and authorizing the contractor and/or other consultants to perform work and/or provide services.
COLLUVIUM:	Generally loose deposits, usually found on the face or near the base of slopes and brought there chiefly by gravity through slow continuous downhill creep (see also Slope Wash).
COMPACTION:	The densification of a fill by mechanical means.

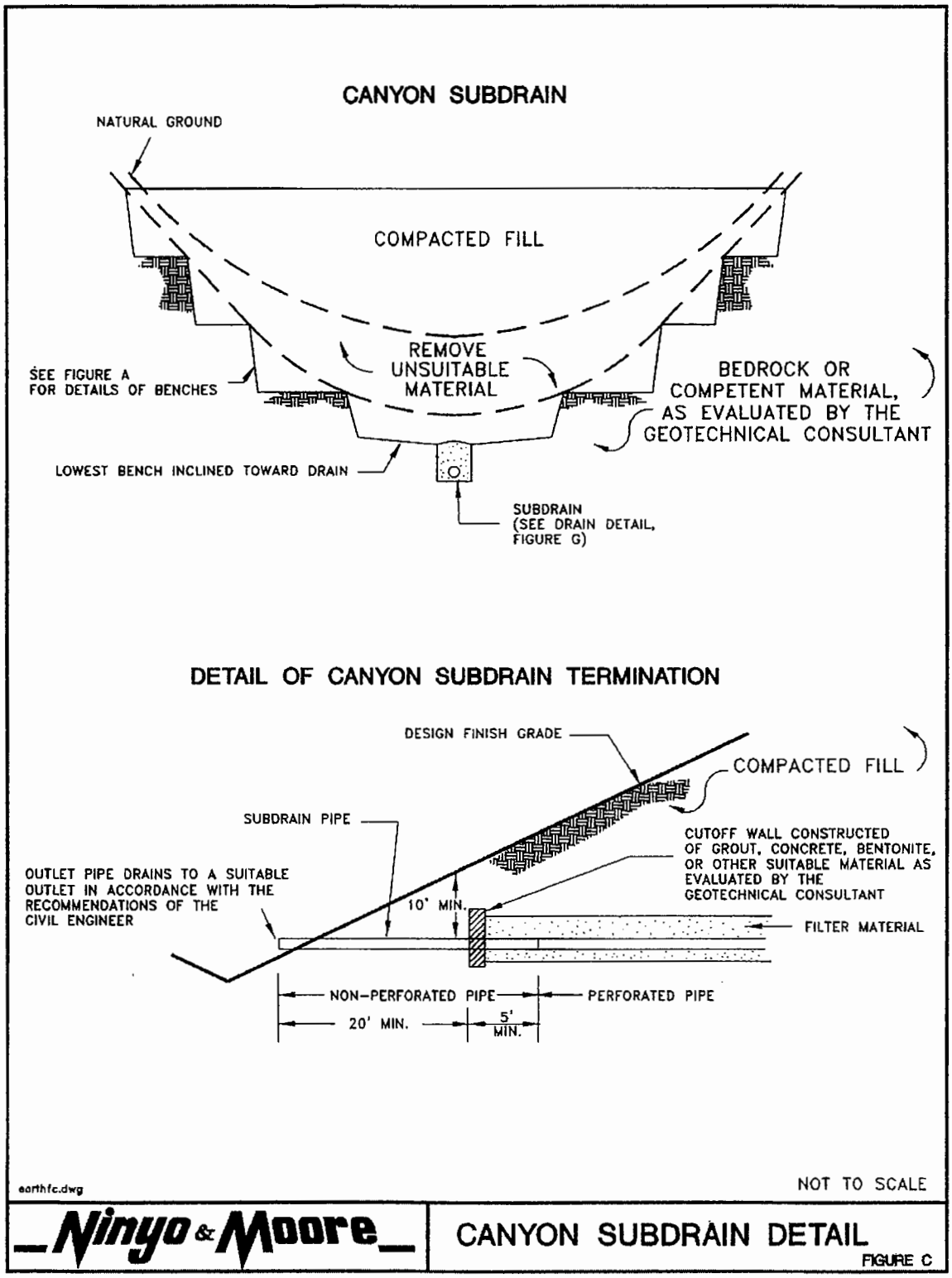
CONTRACTOR:	A person or company under contract or otherwise retained by the client to perform demolition, grading, and other site improvements.
DEBRIS:	The products of clearing, grubbing, and/or demolition, or contaminated soil material unsuitable for reuse as compacted fill, and/or any other material so designated by the geotechnical consultant.
ENGINEERED FILL:	A fill which the geotechnical consultant or the consultant's representative has observed and/or tested during placement, enabling the consultant to conclude that the fill has been placed in substantial compliance with the recommendations of the geotechnical consultant and the governing agency requirements.
ENGINEERING GEOLOGIST:	A geologist registered by the state licensing agency who applies geologic knowledge and principles to the exploration and evaluation of naturally occurring rock and soil, as related to the design of civil works.
EROSION:	The wearing away of the ground surface as a result of the movement of wind, water, and/or ice.
EXCAVATION:	The mechanical removal of earth materials.
EXISTING GRADE:	The ground surface configuration prior to grading; original grade.
FILL:	Any deposit of soil, rock, soil-rock blends, or other similar materials placed by man.
FINISH GRADE:	The as-graded ground surface elevation that conforms to the grading plan.
GEOFABRIC:	An engineering textile utilized in geotechnical applications such as subgrade stabilization and filtering.
GEOTECHNICAL CONSULTANT:	The geotechnical engineering and engineering geology consulting firm retained to provide technical services for the project. For the purpose of these specifications, observations by the geotechnical consultant include observations by the geotechnical engineer, engineering geologist and other persons employed by and responsible to the geotechnical consultant.

GEOTECHNICAL ENGINEER:	A licensed civil engineer and geotechnical engineer, registered by the state licensing agency, who applies scientific methods, engineering principles, and professional experience to the acquisition, interpretation, and use of knowledge of materials of the earth's crust to the resolution of engineering problems. Geotechnical engineering encompasses many of the engineering aspects of soil mechanics, rock mechanics, geology, geophysics, hydrology, and related sciences.
GRADING:	Any operation consisting of excavation, filling, or combinations thereof and associated operations.
LANDSLIDE DEPOSITS:	Material, often porous and of low density, produced from instability of natural or manmade slopes.
OPTIMUM MOISTURE:	The moisture content that is considered optimum relative to correction operations obtained from ASTM test method D 698-00.
RELATIVE COMPACTION:	The degree of compaction (expressed as a percentage) of a material as compared to the dry density obtained from ASTM test method D 698-00.
ROUGH GRADE:	The ground surface configuration at which time the surface elevations approximately conform to the project plan.
SHEAR KEY:	Similar to a subsurface buttress; however, it is generally constructed by excavating a slot within a natural slope in order to stabilize the upper portion of the slope without encroaching into the lower portion of the slope.
SITE:	The particular parcel of land where grading is being performed.
SLOPE:	An inclined ground surface, the steepness of which is generally specified as a ratio of horizontal units to vertical units.
SLOPE WASH:	Soil and/or rock material that has been transported down a slope by gravity assisted by the action of water not confined to channels (see also Colluvium).
SLOUGH:	Loose, uncompacted fill material generated during grading operations.

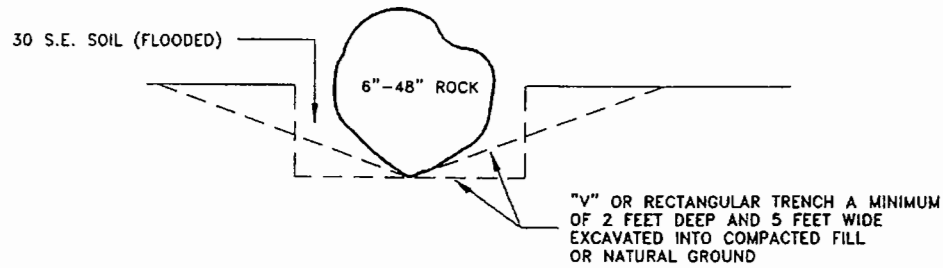
SOIL:	Naturally occurring deposits of sand, silt, clay, etc., or combinations thereof.
STABILIZATION FILL:	A fill mass, the configuration of which is typically related to slope height and is specified by the standards of practice for enhancing the stability of locally adverse conditions. A stabilization fill is normally specified by a key width and depth and by a backcut angle. A stabilization fill may or may not have a back drainage system specified.
SUBDRAIN:	Generally a pipe-and-gravel or similar drainage system placed beneath a fill along the alignment of buried canyons or former drainage channels.
TAILINGS:	Non-engineered fill which accumulates on or adjacent to equipment haul roads.
TERRACE:	A relatively level bench constructed on the face of a graded slope surface for drainage and maintenance purposes.
TOPSOIL:	The upper zone of soil or bedrock materials, which is usually dark in color, loose, and contains organic materials.
WINDROW:	A row of large rocks buried within engineered fill in accordance with guidelines set forth by the geotechnical consultant.


FILL SLOPE OVER NATURAL GROUND
SWALE AT TOP OF SLOPE
COMPACTED FILL
2
1
OUTLET PIPE DRAINS TO A SUITABLE OUTLET IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE CIVIL ENGINEER
NATURAL GROUND
REMOVE UNSUITABLE MATERIAL
4' TYP.
BENCH INCLINED SLIGHTLY INTO SLOPE
10' TYP.
BEDROCK OR COMPETENT MATERIAL, AS EVALUATED BY THE GEOTECHNICAL CONSULTANT
3' MIN.
2%
15' MIN.
BACKDRAIN AND T-CONNECTION (SEE DRAIN DETAIL, FIGURE G)
FILL SLOPE OVER CUT
SWALE AT TOP OF SLOPE
COMPACTED FILL
2
1
NATURAL GROUND
REMOVE UNSUITABLE MATERIAL
4' TYP.
BENCH INCLINED SLIGHTLY INTO SLOPE
10' TYP.
BEDROCK OR COMPETENT MATERIAL, AS EVALUATED BY THE GEOTECHNICAL CONSULTANT
2%
20' MIN.*
OUTLET PIPE DRAINS TO A SUITABLE OUTLET IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE CIVIL ENGINEER
BACKDRAIN AND T-CONNECTION (SEE DRAIN DETAIL, FIGURE G)
*MINIMUM KEY WIDTH DIMENSION. ACTUAL WIDTH SHOULD BE PROVIDED BY GEOTECHNICAL CONSULTANT BASED ON EVALUATION OF SITE-SPECIFIC GEOTECHNICAL CONDITIONS.
NOTES: CUT SLOPE SHALL BE CONSTRUCTED PRIOR TO PLACEMENT OF FILL.
SLOPE DRAINAGE SHOULD BE PROVIDED IN ACCORDANCE WITH RECOMMENDATIONS PRESENTED ON FIGURE E
earthfa.dwg
NOT TO SCALE
Ninyo & Moore
FILL SLOPE OVER NATURAL GROUND OR CUT
FIGURE A

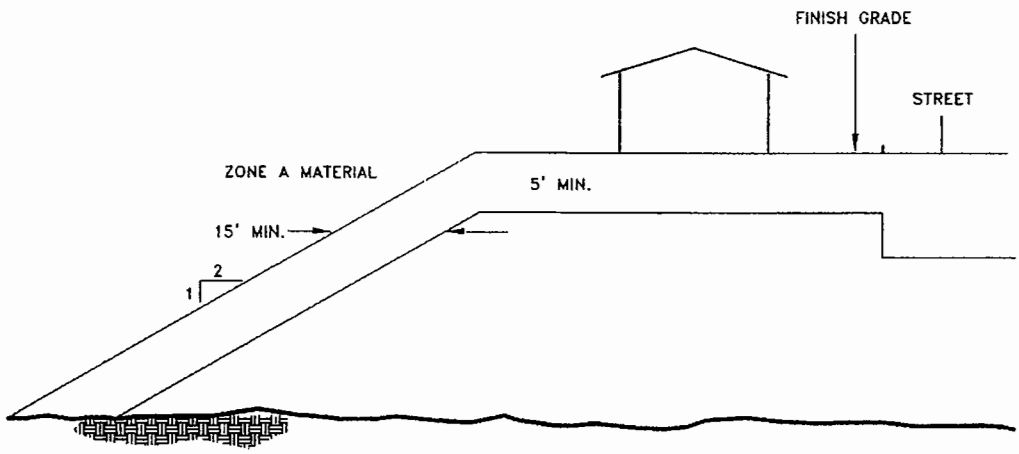

TRANSITION (CUT-FILL) LOT
NATURAL GROUND
5' MIN.
3' MIN.
COMPACTED FILL
REMOVE UNSUITABLE MATERIAL
OVEREXCAVATE AND RECOMPACT
BEDROCK OR COMPETENT MATERIAL, AS EVALUATED BY THE GEOTECHNICAL CONSULTANT
UNDERCUT LOT
NATURAL GROUND
REMOVE UNSUITABLE MATERIAL
5' MIN.
3' MIN.
COMPACTED FILL
OVEREXCAVATE AND RECOMPACT
BEDROCK OR COMPETENT MATERIAL, AS EVALUATED BY THE GEOTECHNICAL CONSULTANT
NOTE: DIMENSIONS PROVIDED IN THE DETAILS ABOVE ARE APPROXIMATE AND MAY BE MODIFIED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT AS CONDITIONS DICTATE.
earthfb.dwg
NOT TO SCALE
Ninyo & Moore
TRANSITION AND UNDERCUT LOT DETAILS
FIGURE B


CANYON SUBDRAIN
NATURAL GROUND
COMPACTED FILL
REMOVE UNSUITABLE MATERIAL
SEE FIGURE A FOR DETAILS OF BENCHES
BEDROCK OR COMPETENT MATERIAL, AS EVALUATED BY THE GEOTECHNICAL CONSULTANT
LOWEST BENCH INCLINED TOWARD DRAIN
SUBDRAIN (SEE DRAIN DETAIL, FIGURE G)
DETAIL OF CANYON SUBDRAIN TERMINATION
DESIGN FINISH GRADE
COMPACTED FILL
SUBDRAIN PIPE
CUTOFF WALL CONSTRUCTED OF GROUT, CONCRETE, BENTONITE, OR OTHER SUITABLE MATERIAL AS EVALUATED BY THE GEOTECHNICAL CONSULTANT
OUTLET PIPE DRAINS TO A SUITABLE OUTLET IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE CIVIL ENGINEER
10' MIN.
FILTER MATERIAL
NON-PERFORATED PIPE
PERFORATED PIPE
20' MIN.
5' MIN.
earthfc.dwg
NOT TO SCALE
Ninyo & Moore
CANYON SUBDRAIN DETAIL
FIGURE C

WINDROW SECTION



PAD SECTION



ZONE A: COMPACTED FILL WITH ROCK FRAGMENTS NO GREATER THAN 6 INCHES IN DIAMETER.

ZONE B: COMPACTED FILL WITH ROCK FRAGMENTS BETWEEN 6 AND 48 INCHES IN DIAMETER MAY BE PLACED IN STAGGERED WINDROWS UP TO 100' LONG IN THIS ZONE AND SURROUNDED BY GRANULAR SOIL (30 SAND EQUIVALENT) DENSIFIED BY FLOODING. ROCK FRAGMENTS LESS THAN 6 INCHES IN DIAMETER MAY BE PLACED IN COMPACTED FILL SOIL.

earthfd flat.dwg

NOT TO SCALE

Ninyo & Moore

OVERSIZED ROCK PLACEMENT DETAIL

FIGURE D